Digital SLR

POCKET GUIDE

www.photoreview.com.au

By Margaret Brown
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Digital SLR
POCKET GUIDE

3rd Edition

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INTRODUCTION

Getting a Grip on a DSLR

Why buy a digital SLR (DSLR) camera when most people are using smartphone cameras to produce photos for posting on social networks? If this is where most of your pictures end up, a smartphone can be a pragmatic choice.

But, for the important events in your life, smartphone snapshots simply don’t cut it. Once-in-a-lifetime holidays should be recorded with versatile and capable equipment. The same is true for landmark family occasions or gatherings of friends. Shoot some portraits; aim to record movies with a professional ‘look’ or try techniques that are a bit out of the ordinary and differences are revealed.

If you’d like to become involved in creative photography, a DSLR is unquestionably the best tool. It will provide the greatest flexibility for capturing all kinds of subjects – plus the best image quality in any situation.

If you’re moving up from a compact digicam to a DSLR, you’ll gain the following benefits:

- Superior overall performance, particularly in dim lighting and at high ISO settings.
- Plenty of user-adjustable controls and a wider range of adjustable settings to control how images are recorded and provide scope for creativity.
- Interchangeable lenses to cover a wide range of focal lengths, including macro and telephoto lenses.

- A decent viewfinder that can be used in all types of lighting and lets you confirm immediately whether shots are in focus and if the lighting is correct.
They also have a few disadvantages worth keeping in mind.

- The camera body is larger and heavier.
- Lenses may be bulky and heavy so you have to carry more weight.
- Changing lenses takes time (and shots can be missed).
- During an exposure, the viewfinder is blocked momentarily.
- Camera operating sounds may be recorded in movie soundtracks.

When you shoot in low light, attempt to capture action at an indoor sporting event, try extreme close-ups or wildlife photography or when you want to control background blurring and isolate the subject, a DSLR is the best tool to use. It won’t fit into your pocket like a digicam or smart-phone but it’s more capable and versatile and will deliver the best quality for your buck.

If you already own a DSLR that’s a couple of years old, you may be thinking of updating.

Prices for entry-level DSLRs have come down lately and they’re often cheaper than some fixed lens models. More up-market models are also cheaper than in the past and provide higher resolution, newer processors and innovative functions to help you take better pictures. So there are plenty of incentives to upgrade.

Deciding which DSLR equipment to buy can be difficult because there are so many choices to make. And you need to understand the new technologies.

This pocket guide explains how to select equipment that will meet your needs and how to use it effectively. It’s written in non-technical language and presents the information in a way that is easy to understand.

When choosing a camera, consider are the types of pictures you wish to take. Will the camera be used mainly for photographing children’s sports, family get-togethers and holidays? Or will you be using it creatively for photographing landscapes, wildlife, street scenes or other non-personal subjects? The first two chapters can help you answer these questions.

The remaining chapters will cover issues associated with using your camera creatively, including tips on lenses, using different camera settings, focusing and colour controls. We’ll also take an in-depth look at raw file capture and shooting movies with a DSLR and finish up by examining ways to edit and share photos.

The Photo Review website (www.photoreview.com.au) publishes reviews of the latest imaging equipment, along with news updates and tips on buying and using digital cameras. You can also locate Australian retailers that offer good deals on equipment purchases and have knowledgeable staff to help you make the right buying decisions.
When to Upgrade

If you already own a DSLR camera, deciding when to upgrade and what type of camera to upgrade to can be challenging. The following suggestions will help you to make a wise decision:

1. A new camera won’t make you a better photographer unless it provides functions you don’t already have.
2. If you’re already shooting with a 12-16 megapixel camera and capturing raw files, you won’t require more resolution to make big prints using typical desktop equipment.
3. If you want more pixels for cropping flexibility, the downside is that you’re discarding resolution by cropping. And more pixels means smaller pixels on a given sensor size, with the associated issues at high sensitivity settings.

Nevertheless, if your current camera is several years old changing up may be inevitable. Certain camera components can ‘wear out’ and fail over time. In addition, with each generation, image processors become more capable of producing low noise at high ISO settings and managing fast burst speeds.

If you have money to invest, it can be worthwhile upgrading to a larger sensor or newer processor. But check the camera specifications carefully as the same processor chip can span several generations of cameras.
Four manufacturers dominate the DSLR market: Canon, Nikon, Pentax and Sony (which purchased Minolta’s intellectual property and retains the same lens mount). Of the minor market players, Olympus is committed to maintaining its Four-Thirds system (currently represented by the E-5), which uses smaller sensors than the other manufacturers but has been ‘designed for digital’. Leica and Sigma each market a single model plus a relatively small collection of lenses.

In this chapter we’ll investigate the most important feature camera buyers should consider: the size and resolution of the camera’s sensor. We’ll also look at the different types of cameras available for buyers to choose from, concentrating on the major manufacturers and explaining how different camera types suit different categories of users.

Sensors

Large sensors are a major reason why most photographers choose DSLR cameras and, although other camera types have begun adopting this advantage, it remains a feature you can guarantee when you buy a DSLR. Because sensors are expensive to manufacture they make a significant contribution to the overall price of a camera and account in part for differences in pricing between cameras with different sized sensors.

The CMOS sensor chip from a professional DSLR camera. (Source: Canon.)

Most DSLRs fit into one of two classes, based on sensor size. For convenience, we’ll use Nikon’s nomenclature: FX for cameras with 36 x 24 mm sensors (the same area as a 35mm film frame) and DX for APS-C sized sensors, which have an area of approximately 23.5 x 15.7 mm. There’s a third class, built around a Four-Thirds (4/3) format sensor (which measures 17.3 x 13.0 mm) but Olympus is the only company to offer a camera with this type of sensor.
Of the major manufacturers, only Canon, Nikon and Sony offered cameras with FX sensors when we went to press. Pentax produces professional medium-format cameras with even larger sensors but its DSLR offerings concentrate upon DX. Among the minor market players, Olympus is committed to maintaining its Four-Thirds system, which is currently represented by the E-5. Although it uses smaller sensors than the other manufacturers, the camera body – and, more importantly, its lenses – have been ‘designed for digital’ ever since the system was launched in 2002.

Until recently, most FX cameras have been built for professional photographers and priced accordingly. However, 2012 has seen the arrival of entry-level FX-format DSLRs that compete in price with high-end enthusiasts’ cameras.

Most entry-level and enthusiast cameras have DX sensors, which range in size from approximately 23.5 x 15.6 mm to 22.3 x 14.9 mm. Relative to digicams and smart-phones, the sensors in these cameras are still large; but they’re not as big as full frame sensors.
How many megapixels do you need?

A lot of the heat has gone out of the ‘megapixel wars’ that have dominated the camera market from the beginning. And most camera buyers have come to realise there’s a point, beyond which paying for pixels you don’t need is a waste of money. It’s better to invest in a camera with a better quality lens, larger sensor and more effective image processor.

However, a lingering feeling that more pixels can be advantageous still drives camera development and, until consumers begin clamouring for larger pixels, rather than more pixels, it’s likely to hang around.

So, how many pixels do you actually need in your DSLR’s sensor? It largely depends on how big you want to print your pictures and how much you are likely to crop images after you’ve taken them. More megapixels means more detail is recorded and, consequently, you can make larger prints or apply more savage cropping.

If you base your choice on the first criterion, it’s unlikely you will need more than 18 megapixel resolution from your camera. The diagram below shows the optimal sensor resolution for three popular print sizes at the standard print resolution of 300 dots per inch (dpi).

Because larger prints are viewed from greater distances, resolution requirements go down as you increase print size, so there is little difference between, say, an 16-megapixel sensor and a 20-megapixel sensor. It is possible to make excellent A3 (and A3+) prints from 8- or 10-megapixel DSLR cameras and A2-sized prints from 12-megapixel or higher cameras.

Some portrait photographers invest heavily in cameras with high-resolution sensors to capture more pixels for portraits. They then spend hours in...
post-production cloning out blemishes that may not have been picked up had the sensor’s resolution been lower.

It’s actually possible to have higher resolution that you need – or can use. More pixels often means more post processing to remove details in photos that you’d rather not have.

As a test, take one of your best images, reduce it to 1920 x 1080 pixels to match Full HD screen resolution and display it on your widescreen TV set. While a close examination of the screen may reveal individual pixels (provided the screen is sharp enough), you’ll find what is effectively a two megapixel image looks just great at the correct viewing distance.

If the ability to zoom in by cropping plays an important role in your photography, you should think about the reasons you crop: do you lack a suitable telephoto lens or are you just reluctant to move closer to subjects? Your answer should reveal how you can minimise the need to crop – which is desirable if you want the best image quality your camera can deliver.

Each time an image is cropped, pixels are removed and overall resolution is reduced. It doesn’t make sense to pay for pixels you’re in the habit of throwing away.
Why Sensor Size Matters

The larger the image sensor with respect to the number of ‘pixels’ it produces, the higher its potential light-capturing ability. More light gives the camera’s image processing system more information to work with. Consequently, the camera can record a wider range of tones and reproduce colours more accurately than a compact digicam. It will also produce sharper and less grainy-looking pictures in dim lighting.

It’s quite easy to calculate the approximate pixel size for any camera’s sensor. Simply divide the length of the longest side of the sensor by number of pixels in the longest dimension of the highest-resolution image. (This calculation works just as well when the shorter sides of the image and sensor are used.) The table below compares pixel size for the three DSLR sensor formats and a typical digicam sensor on the basis of 18-megapixel output resolution (which produces images 5184 pixels wide).

Larger sensors require larger camera bodies to accommodate them – and also larger lenses. While this might not matter much for professional photographers who work in studios, it can make a huge difference in the amount of gear you carry when you travel. If you’re keen on wildlife photography or enjoy hiking or bushwalking, you’ll need to think carefully before investing in a full frame system.

Although other cameras may offer the same megapixel resolution as a DSLR camera, the individual light-capturing photosites on a DSLR’s sensor are usually four to six times larger than those in a compact digicam’s sensor. It’s worth paying more for a larger sensor when you need superior performance in low light levels and with long telephoto lenses.

Image Processors

The image processor in a DSLR is used to convert the raw data from the image sensor into a colour-corrected image. Typically, a processor consists of a silicon chip plus the software that drives it. Each manufacturer has its own brand name for its image processor. Canon uses

<table>
<thead>
<tr>
<th>Pixel dimensions</th>
<th>FX</th>
<th>DX</th>
<th>4/3 System</th>
<th>Digicam</th>
</tr>
</thead>
<tbody>
<tr>
<td>5184 x 3456 pixels</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Sensor dimensions</td>
<td></td>
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<tr>
<td>36 x 24 mm</td>
<td>23.5 x 15.6 mm</td>
<td>17.3 x 13.0 mm</td>
<td>7.6 x 5.7 mm</td>
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<td>Pixel size</td>
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<td>6.9 microns</td>
<td>4.5 microns</td>
<td>3.3 microns</td>
<td>1.5 microns</td>
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</tbody>
</table>

Most manufacturers update their processor chips periodically, introducing new algorithms that are better able to calculate processing parameters. Some add extra chips that enable cameras to handle image data faster and/or use more sophisticated processing algorithms.

Professional DSLRs often have several processors devoted to image processing plus additional chips that handle focusing and metering. They increase the price of these cameras – but also their capabilities and performance.

As sensor technology progresses, the technology for interpreting the data (image processing) will also advance. While future cameras will have more efficient sensors, processors are likely to keep pace – or even out-class sensor developments.

New processors have also introduced functions like noise reduction, edge enhancement, dynamic range adjustment; not to mention a raft of in-camera special effects. Each new generation of processors will almost invariably improve imaging performance, particularly with respect to processing speeds and minimising the effects of noise in shots taken at low light levels. They can also provide
worthwhile improvements to video performance.

It’s worth paying attention to the image processor when buying a new camera and you can benefit from having the latest processor, even though the camera may cost a little more.

**Market Differentiation**

The DSLR market splits into three main categories, each catering for a different level of expertise (and preparedness to invest in equipment). Professional photographers require ‘workhorse’ cameras that are ruggedly built and will keep operating in all kinds of conditions.

Consumers prefer smaller cameras and rarely subject them to the workload a pro camera routinely handles. Size, weight and price are usually the key factors underpinning camera choice. In between these extremes are photo enthusiasts, who want good gear but can’t justify paying several thousands of dollars for it. They also tend to want cameras that are lighter than pro models but still provide many professional features.

Factors influencing camera choice in each group include build materials, components and quality control during manufacture. The table on next page compares the main differences between professional, enthusiast and consumer DSLRs.

* Pentax’s K-30 is unusual for a consumer DSLR because it has a weather-resistant body, a feature usually only found on high-end cameras. (Source: Pentax.)

* Cameras designed for serious photo enthusiasts will accept professional-quality lenses, which makes them a useful upgrade path for aspiring pro photographers.
You'll notice resolution is not included in the above table. While it's important to have enough resolution for a particular output size, as mentioned, the take-away message is that a camera's megapixel count is no longer the main gauge of its ability to produce high-quality images; the size and light-capturing ability of the pixels themselves is more important.

So is the ability of the photographer to operate the camera. Chapters 2 and 3 provide more information on this topic.

### USEFUL URLs

The following websites provide additional information on the topics covered in this chapter.

- [http://www.kenrockwell.com/tech/mpmyth.htm](http://www.kenrockwell.com/tech/mpmyth.htm) on why small differences in megapixel count are unimportant.
CHAPTER 2
Buying Guide

Having looked at the equipment available, it’s time to move on to the human side of the equation and consider what you should really pay attention to when buying a new camera. Aside from a small group of camera collectors, most people buy cameras to take pictures. And they buy new cameras with the aim of taking better pictures.

But what do you need to create a picture? A sensor, a lens and the ability to control exposures. Even the most basic cameras provide those things. If you’ve chosen to invest in a DSLR, you’re looking for more.

Matching DSLRs to Users’ Needs

The relationship between user and equipment is not necessarily straightforward. Different photographers have different requirements in the cameras they choose. When shopping for a camera, make sure you have some hands-on experience (which usually means visiting a retail store).

Cameras that don’t feel comfortable to use will inevitably end up in storage cupboards. To get the most from the money you spend, pay attention to camera ergonomics, checking the following:

• Does the camera body sit comfortably in the user’s hands, allowing frequently-used buttons and controls to be easily reached?
• Is the view through the viewfinder clear and bright enough for indoor shooting?
• Can the LCD monitor display a readable view of menu screens and displayed images in outdoor lighting?
• Would you be happy to carry the equipment on a day excursion, holiday trip or overseas adventure?

Some additional features may need to be considered to achieve the best match between a photographer and a camera.

It’s important to choose a camera that feels comfortable to hold and places key controls within easy reach. (Source: Sony.)
type. We’ve outlined a variety of different types of photographers with camera type suggestions below.

1. **Novice Buyers** of DSLR cameras usually want to learn more about photography and turn it into a rewarding pastime. Photographers in this category are often stepping up from a digicam to a DSLR or swapping from a film camera to a digital camera. Although the latter may have some photographic knowledge and expertise, their understanding of digital technology may be sketchy so they need simple ways to translate their existing knowledge to the new digital platform. Entry-level models are ideal for these photographers, particularly if they include pre-set scene modes and guide or help screens to explain various camera controls. Live view shooting will be particularly useful as it allows the camera to be used in the same way as a digicam for composing and capturing shots.

2. **Family Photographers** normally look for a camera that will take better pictures than their digicams and offers greater versatility. Many of these buyers acquire new cameras before special events, such as holidays and family celebrations.
People in this group could also focus on entry-level models that are simple enough for both parents and teenagers in the family to operate. Twin lens kits (which contain both wide and tele zoom lenses) can be a worthwhile investment, particularly for travelling and/or if some family members are involved in active sports. A 75-300mm lens provides a great range for sports and outdoor photography, while an 18-55mm lens is ideal for indoor shots, group portraits and party photos.

3. **Photo Enthusiasts** upgrading from an existing film or digital SLR camera will usually look for the latest model from the same manufacturer as their existing camera in order to continue using favourite lenses (and other accessories). Many photographers in this group will focus on models that offer higher resolution, greater functionality and better durability.

   Factors to look for include the latest image processor, higher monitor resolution and improved viewing technologies. Additional functions that could improve your photography (such as noise-reduction processing, in-camera dynamic range adjustment and focusing aids like peaking indicators) could also provide incentives to upgrade. Improvements to video recording (higher resolution, better audio and external microphone support) are other reasons to consider upgrading.

4. **Outdoor Photographers and Bushwalkers** need cameras with strong and well-built bodies that include adequate dust- and moisture-proof construction. Weight is an important element in choosing a camera and lens(es), particularly for photographers who go on location for several days at a stretch.

   For most photographers in this group, a single, extended-range zoom lens could be a better solution than carrying several lenses, even though it compromises low-light shooting and imaging performance.

![Photo enthusiasts should look for cameras that will increase their shooting capabilities.](image-url)
Reducing the need to change lenses in the field will reduce the risk of dust or moisture entering the camera and also ensure their camera is always ready to use when that once-in-a-lifetime wildlife shot appears.

Alternatively, a short zoom lens plus a long, fast tele lens could meet many photographers’ requirements with no compromises in performance. Macro lenses may also be a desirable addition to some outdoor photographers’ kits.

5. Aspiring Professional Photographers need a camera to learn their craft on. Because they will probably transition to a professional camera once their learning days are done, rugged construction is less important than having all the functions required in professional photography at their fingertips.

   Lens choices are also less relevant than having high-performance lenses that will provide eye-catching pictures for their portfolio. At this stage, it may be more important to invest money in a really good lens and fit it on a secondhand professional camera or a high-end enthusiasts’ camera.

6. Professional Photographers are looking for tough and versatile workhorse cameras that will keep going day after day and be usable in a wide range of situations. Different types of professionals will require different types of cameras and different lens kits, depending on the work they do.

   Studio photographers need very high resolution and the ability to use the camera with professional studio flash systems. The ability to shoot with the camera ‘tethered’ to a computer may be another requirement.

   Wedding photographers (especially those who work without assistants) often get by with high-end enthusiasts’ cameras because they provide greater mobility for hand-held shooting yet their performance is close to professional standard. Many photographers will carry two cameras to allow simultaneously shooting, say, monochrome and colour (or stills and video) or with lenses of differing focal lengths.

   Sports and wildlife photographers require cameras with high continuous shooting speeds, large internal memories and a comfortable balance with long telephoto lenses. Many photographers in these groups use fast ‘prime’ lenses, which are very heavy. A tripod or monopod is often needed to ensure steady shots. Lenses with built-in stabilisation are a must for hand-held shooting.
Your First System

Cameras are available at all levels, from high-end professional to entry-level, so it’s relatively easy to pick a starting point to base your choices upon. Before you invest in a DSLR, make a list of the subjects you like to photograph and then refer to Chapter 3 to find out what kinds of lenses you will need and which focal lengths best suit your favourite types of shots.

Decide how much you are prepared to spend and whether you want to buy a system all at once or gradually add components to the camera body. Then visit a camera store or check out the websites for the manufacturers whose cameras appeal to you and find out whether their ranges include the lenses you want.

Don’t expect all camera manufacturers to offer the same range of lenses and accessories. It pays to survey the different products on offer before choosing which manufacturer’s camera body to buy.

When buying your first DSLR (or swapping from one manufacturer to another) you will probably be offered a kit, either with one or two lenses. Most entry-level kits (based on a DX body) begin with an 18-55mm lens, adding a 75-200mm lens to the twin lens kit. Such kits allow you to shoot subjects that range from landscapes to moderate close-ups and action shots.

Sports and wildlife photographers who use long telephoto lenses need cameras that are heavy enough to counterbalance the weight of the lens when a monopod or tripod is used to ensure steady shots.
They usually represent the best value for money, too, and are the best choice if your budget is limited.

If you’re a family snapshotter or frequent traveller, you may want to start with an ‘all-in-one’ lens with a focal length that ranges from, say, 18mm to 200mm. This allows you to minimise the weight and bulk of the gear you carry as well as providing the convenience of not having to change lenses.

If your budget is limited but you’re also highly motivated to save (and capable of saving) money, you could draw up a schedule of step-by-step investments. Some items are worth buying secondhand, provided they’re in good condition.

It’s best to buy a new camera body because it will ensure you have the latest sensor and image processor. Technological developments are still taking place in both areas and many
photographers invest in new bodies every second or third generation to keep up with the latest improvements.

Lens technologies move at a slower rate so it's worth considering the secondhand market when you shop. Check items carefully to ensure they haven't been mishandled before parting with your cash. Look for dents and scratches on lens barrels and mounts and discolouring on optical components.

Put the lens on your camera body and take a few shots with it at varying aperture settings so you can check its performance. (Photographing the classified advertisements page of a newspaper at various distances is an easy way to check centre and edge sharpness visually.)

Examine your test shots carefully, paying close attention to sharpness in the centre of the field of view and whether colours are accurately reproduced. Poor contrast can indicate problems with lens coatings or misaligned elements caused by long-time abuse.

Plastic lens mounts can become worn and cause the lens to fit loosely. Both problems indicate a lens that should be avoided.

**DSLR Viewfinders**

Aside from large sensors, the main factor that characterises DSLR cameras is reflex viewing systems that let you see the world as it is (not via a digitised display). Both reflex viewfinders and large sensors require relatively large camera bodies.

Single-lens reflex viewing systems direct the light that enters the lens through a series of mirrors and lenses to the photographer's eye, enabling the photographer to view the scene exactly as it will be recorded on the film or with the image sensor. The diagram above shows the light path.
Because pentaprisms are made completely from glass they are relatively heavy and costly to manufacture, which means they’re usually found on professional and high-end enthusiast cameras. In entry- and mid-level DSLRs, pentamirrors replace pentaprisms because they’re cheaper to manufacture and lighter.

A pentamirror redirects light in the same way as a pentaprism, but it’s made from several separate mirrors, which means there’s air in the central chamber instead of a block of solid glass. The air/glass interfaces at each individual mirror can cause light loss, making pentamirror systems less bright than pentaprisms.

When choosing a camera, weigh up the advantages of each system, using the table above.

Associated with the camera’s viewfinder is a metering sensor that measures the light entering the camera and helps to determine exposure levels. There’s usually also a focusing screen (which is interchangeable in professional and high-end enthusiast cameras) and a transmissive LCD screen for displaying shooting information.

Light passing through the viewfinder is focused by a series of eyepiece lenses, which can be adjusted to suit different users’ eyesight. Dioptre adjustment sliders or knobs are generally located to the side of the finder housing.
A Different View From Sony

Sony recently introduced a different viewing system in its DSLRs, starting with the Alpha SLT-A55. Instead of using a normal mirror to reflect light into the viewfinder, Sony’s SLT cameras have a fixed, semi-transparent mirror that allows most of the imaging light to pass directly to the image sensor. The remaining light is reflected to the autofocusing sensor where it supports the camera’s phase detection autofocusing system.

In this system, the imaging light doesn’t reach the viewfinder so SLT cameras have electronic viewfinders (EVFs) that take the image signal directly from the sensor. EVFs are miniaturised TV screens, which means you’re looking at pixels. The same technology is used in other cameras when operating in live view mode. The advantages and disadvantages of the Sony SLT system are outlined below:

Advantages:

• The camera can use continuous phase-detection autofocusing in all shooting modes, including video, live view and continuous (burst) shooting.
• Because there’s no mirror movement, shutter lag is virtually eliminated and very fast burst speeds can be supported.
• No mirror movement reduces the chance of camera shake.
• The same shooting information can be displayed in the EVF as on the monitor screen.
• Depth-of-field, exposure value and white balance can be verified in the viewfinder and adjusted, if necessary, before the shot is taken.

Disadvantages:

• Because part of the light is reflected to the AF system, the light that reaches the sensor is reduced by up to 30%.
• There’s a short but perceptible delay between the real world action and the continuously displayed viewfinder image due to the need for the image to be processed.
• High EVF resolution is required to display details in the subject.
• Ghosting can affect EVFs when they are pointed towards bright light sources.
• Accurate colour reproduction can’t be guaranteed (compared with an optical viewfinder).
• Power consumption is relatively high, compared with negligible for an optical viewfinder.
How Important is Brand Loyalty?

Because interchangeable lenses are the norm for DSLRs, when you buy a camera your choice ties you to a particular manufacturer’s system and its range of accessories. Canon lenses will only work with Canon bodies and the same is true for Nikon, Pentax and Sony.

If you already have a film SLR plus several lenses, should you look for a DSLR from the same manufacturer? Not necessarily. Lenses designed for 35mm cameras may not provide the best possible performance on a DSLR body when the camera’s sensor is smaller than a 35mm film frame. It’s usually better to buy a camera with a matched, designed-for-digital lens.

However, if money is tight, being able to use your existing lenses on your new DSLR body is a cheap way to expand your options. But remember to take account of the crop factor that will apply when you fit the 35mm lenses to your new DSLR body (see Chapter 3).

In addition, older lenses may not provide the electronic contacts required for autofocusing and full-aperture metering. In such cases, you’ll be forced into shooting with full manual control.

Buying into a particular manufacturer’s system doesn’t commit you to using only its branded components (lenses, flashguns, grips and filters). But it does reassure you that they are usable with your camera body.

Third-party lens manufacturers like Sigma, Tamron and Tokina produce lenses with mounts to suit all major brands. Provided you select the correct mount, lenses from these manufacturers should work as well as the camera body manufacturer’s lenses.

USEFUL URLs

The following websites provide additional information on the topics covered in this chapter.

- [www.bythom.com/bigtrip.htm](http://www.bythom.com/bigtrip.htm) buying advice from Nikon guru, Thom Hogan.
- [www.bythom.com/weight.htm](http://www.bythom.com/weight.htm) more advice from Thom on travelling with photo equipment.
CHAPTER 3
Lenses: The Heart of a System

The quality of the camera’s lens is as important as the size and resolution of the sensor. It’s also important to match the lens to both the camera body and the types of pictures you want to take. Buying a DSLR camera with the manufacturer’s ‘kit’ lenses will ensure the lens(es) suit the camera body. It’s also an affordable way to start your system.

Most DSLR cameras are offered with one or two zoom lenses. For cameras with FX sensors, a good start is a 24-105mm zoom plus a 70-300mm zoom. Cameras with DX sensors are almost always offered with 18-55mm and 55-200mm zooms.

Factors That Matter
If you want the best optical quality from a lens, there are six factors to evaluate, listed in order of importance:

- Sharpness;
- Vignetting, which appears as edge and corner darkening;
- Flare, which produces streaks, patterns or an overall haze that reduces contrast and colour vibrancy.
- Rectilinear distortion;
- Chromatic aberration, which is often revealed as coloured fringing along high-contrast boundaries;

Twin lens kits, such as the one shown above from Sony, represent an affordable way to start your system.

The illustrations above show the effect of vignetting. Progressive edge and corner darkening can be seen in the top picture, with a corrected image in the lower.
Bokeh, a term than defines the smoothness of out-of-focus areas in an image.

The latest DSLR cameras provide the ability to correct chromatic aberration, rectilinear distortion and vignetting with in-camera processing. These aberrations are also relatively easy to correct when you convert raw files and edit images. Flare isn’t correctable at present but its affects can be reduced by fitting a lens hood when photographing backlit subjects.

Bokeh can only be assessed when backgrounds are sufficiently blurred to isolate the subject. The more blades in the aperture diaphragm, the smoother the bokeh is likely to be. Some lenses can’t produce the level of softness needed for attractive bokeh.

Lack of sharpness can’t be easily corrected. Sometimes a lens will be sharp in the centre of the field but produce blurring in the periphery of the image. This can be acceptable for portraiture and some close-up work but is unacceptable in landscape and architectural photography.

**Lens Jargon Explained**

The **aperture** of a lens is the opening that allows light to pass through the lens to the image sensor. The size of the aperture is controlled by an **iris diaphragm**, which works in much the same way as the pupil in your eye.
The f/numbers that define aperture settings indicate the ratio between the diameter of the aperture and the focal length of the lens. The maximum aperture is the widest the iris can be opened for a particular focal length.

All lenses are specified by focal length in millimetres and maximum aperture. Aperture settings for DSLR lenses typically cover the following range: f/1.4, f/2.0, f/2.8, f/4, f/5.6, f/8, f/11, f/16 and f/22. Note: the smallest number represents the largest lens aperture.

If the maximum aperture is large (f/2.8 or wider), the lens is termed ‘fast’. Fast lenses admit more light and allow photographers to focus on a narrow plane in the subject, leaving both the background and foreground unsharp.

Exotic Glass and Coatings
Modern lens designs often make use of exotic glasses to minimise common aberrations (faults that can affect image quality). Aspherical (‘Asph’ or ‘ASL’) elements are popular because they cause all light rays passing through the lens to converge at a single point. These elements are used to reduce the number of components in the lens system and make it more compact, while also delivering improved optical performance.

Apochromatic (‘APO’) lenses use special, low-dispersion glass to reduce the incidence of coloured fringes along areas of high contrast. Such lenses can be designated ‘LD’ (Low dispersion), ‘AD’ (Anomalous dispersion), ‘ED’ (Extra-low dispersion) or ‘UD’ (Ultra-low dispersion). These glasses are quite popular in telephoto lenses.

Most modern lenses come with external and internal coatings that suppress internal reflections, which can cause flare and ghosting when backlit subjects are photographed. Effective coatings maintain image contrast and colour reproduction.

The above illustration shows the iris diaphragm, which controls the aperture in a lens, stopped down (top) and wide open (bottom). (Source: Canon.)
With slower lenses, the plane of focus is wider, making it more difficult to isolate the subject.

**Zoom** lenses are specified with the focal length range followed by the maximum aperture range. A 28-105mm f/4-5.6 lens, for example, has its widest field of view and maximum aperture at 28mm and f/4 and zooms to a focal length of 105mm with a maximum aperture of f/5.6.

Maximum apertures of zoom lenses usually become smaller as focal length increases, although some can maintain a constant maximum aperture throughout their zoom range. A 70-200mm f/2.8 lens will allow photographers to shoot with a maximum aperture of f/2.8 all the way up to the full 200mm zoom extension. Such lenses are always bigger, bulkier and more expensive than those with varying maximum apertures, although they are usually better performers.

Zoom lenses span a range of focal lengths. They’re popular for their convenience and cost-effectiveness but are usually slower than prime lenses and also much more difficult to design. The longer the zoom range, the more compromises must be made to keep the lens at a convenient size and price. Large maximum apertures is the first compromise; few zoom lenses are faster than f/3.5 at the wide position and f/5.6 when zoomed in. This can make it difficult to reduce busy backgrounds to a blur.

Zoom lenses also make photographers lazy. Instead of moving closer to the subject, they can zoom in and shoot without having to worry about the focus. This can lead to less sharp images and a loss of context.
subject, they simply zoom in. In doing so, they can’t take advantage of the different perspective characteristics of different types of lenses.

Prime lenses cover only one focal length. They’re usually two or more f-stops faster than zooms. Their design is usually simpler and the lens can be optimised to deliver outstanding quality at its designated focal length, usually across a wide range of apertures. If you want top image quality, a prime lens will deliver it.

Lens Characteristics
Different types of lenses can impart a particular ‘flavour’ to pictures, making them a useful creative tool. Normal lenses provide much the same view of a scene as the human eye. For FX cameras, this perspective is provided by 50mm lenses; for DX cameras, it’s around 33mm.

Wide angle lenses cover a wider than normal angle of view and are often used for landscape photography as well as architectural shots and for shooting groups of people in cramped spaces. If you photograph a subject with normal and wide angle lenses from the same position, both lenses will capture the same perspective but the wide angle lens will give a wider angle of view. Move in closer with the wide angle lens and the perspective will change to exaggerate differences between near and distant elements in the scene.

Telephoto lenses magnify distant objects, enabling you to fill the frame with them. Super telephoto lenses are very large and heavy because a lot of expensive glass is required to provide high magnifications.

Fish-eye lenses are ultra-wide angle lenses that introduce strong visual distortions, which are associated with the way the extremely wide angles of view are obtained. Instead of trying to produce images with normal straight lines of perspective, they ‘map’ the scene to fit the viewing angle. This makes lines close to the periphery of the frame bulge outwards.

In circular fish-eye lenses, the entire scene is contained within a circular area in the image frame. The rest of the frame appears black because no imaging light reaches those areas.
Stabilisation systems help to prevent shots from becoming blurred due to camera shake. They can allow photographers to use shutter speeds a couple of exposure values (EVs) below the recommended settings in an unstabilised camera.

Most systems can only counteract the blur that results from the normal, relatively tiny amount of shaking associated with hand-held shooting. They can’t prevent motion blur caused by the movement of the subject or by extreme movements of the camera.

Stabilisation is valuable when you have to shoot with the camera hand-held in dim lighting. It can also be handy for close-up shooting when even tiny vibrations become magnified.

Camera buyers have two choices when purchasing a camera with image stabilisation. They can look for cameras that use optically-stabilised lenses or choose cameras with the stabilisation built into the camera body. Although both are almost equally effective, the advantage with moving the image sensor, instead of the lens, is that stabilisation is available with any lens you care to use – including wide-angle lenses, where it’s rarely provided.
Stabilised lenses are usually larger, heavier and more expensive than unstabilised lenses because they contain more components. Most systems are based on two built-in gyro sensors, which detect movement in the horizontal and vertical planes and counteract it by shifting a group of internal elements with respect to the optical axis of the lens.

Different manufacturers use different ways to indicate when cameras or lenses are stabilised. Sony’s SteadyShot Inside system indicates in-camera stabilisation that works by shifting the image sensor to compensate for camera movement. Olympus uses a similar system, based on its Supersonic Wave dust removal technology.

Different lens manufacturers attach letters like ‘IS’ (for Image Stabilisation), ‘VR’ (for Vibration Reduction) or ‘OS’ (for Optical Stabilisation) to their product names. Many lenses provide two stabilisation settings, one for photographing stationary subjects and the other for moving subjects.

Image stabilisation is particularly useful for close-ups, when even slight camera shake can produce blurring. The stabilisation system in some IS lenses must be switched off when you mount the camera on a tripod; other lenses detect tripod mounting automatically.

Focusing Motors

While most DSLRs can record movies as well as stills, the built-in microphones on the camera will often pick up the sounds made by camera adjustments and record them on movie soundtracks. Autofocusing and zooming are the leading sources of this unwanted noise.

Most high-performance lenses are driven by ultrasonic motors (USM) instead of the noisier and often slower micro motors used in cheaper lenses. Ultrasonic motors use tiny electronic vibrations to drive focusing.

The focusing action is fast and quiet, with virtually instantaneous stops and starts and minimal power drain. This makes these lenses ideal for use when recording movies with a DSLR.

Different manufacturers use different acronyms for their systems: USM, HSM, USD, SWM, SDM, SSM. Some companies use motors that combine a micro motor with ultrasonic vibrations. These systems are cheaper to produce but slower to focus than ring-type USMs.

Choosing the Right Lens

Once you’ve established a basic system, you can add lenses, based on your own particular interests. The tips below highlight features to consider when choosing lenses for different types of subject.

Landscape Photography: Wide-angle lenses are ideal, with the best focal
**LENSES**

The only way to obtain a shot like this was with a fast telephoto lens, which provided the magnification for a close-up view plus the ability to obtain an adequate depth of focus in relatively dim lighting.

A typical landscape shot, taken with a 24mm lens on a FX DSLR camera.

Note the slight distortion in perspective imparted by the photographer’s low viewing angle, chosen to emphasise the sky.

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Length ranges being between 14mm and 28mm for FX cameras and 10mm and 24mm for cameras with DX sized sensors. Watch for potential distortions at the shorter focal length in these ranges. Some are correctable in the camera and/or post-capture but results are variable.

Fish-eye lenses are sometimes used for landscape photography because they cover extremely wide angles of view. However, they also introduce geometric distortions that will affect the appearance of the image.

**Portraiture:** Medium telephoto lenses come into their own here, particularly if they are fast (f/2.8 or wider). Optimal focal lengths are between 75mm and 110 mm for FX cameras and 55mm and 90mm for cameras with DX sized sensors.

Professional portrait lenses include adjustable soft-focus filters to suppress skin blemishes. (Soft focus filters are also available as optional accessories.)

**Wildlife:** Fast telephoto lenses are a must; at least 300mm for FX cameras and 500mm for cameras with DX sized sensors. Use a tripod or monopod to support the lens, which will probably weigh at least a kilogram.

**Close-ups:** While many lenses will focus to within about 30 cm of subjects, if you want to take macro shots only true macro lenses provide life-size (1:1) reproduction. They’re ideal if you enjoy taking shots of flowers, small creatures...
and valuables such as jewellery and the like. Zoom lenses with ‘Macro’ capabilities will focus close to the subject but seldom provide more than half life size reproduction.

**Underwater**: Moderately wide zoom lenses are the most suitable but they must be compact enough to fit into a waterproof housing with your DSLR. You may need to sacrifice some lens speed to accommodate a lens. Consider 16-35mm for FX cameras or 10-22mm for DX cameras.

**Travel**: Cameras with DX sized sensors come into their own where size and weight must be minimised. Many travellers appreciate the convenience of a single, extended range zoom lens covering focal lengths from 28mm to 250mm or 300mm.

But when making this choice you must recognise that the longer the zoom range, the more imaging performance will be compromised, as outlined previously. These issues must be accepted when you prioritise size and weight because it takes a lot of glass to make a fast telephoto lens.

**Accessories**

A **lens hood** shades the front element of the lens and minimises the risk of flare and ghosting. Hoods are important accessories because they help to ensure images are recorded with optimal contrast and colour fidelity.

> Convenience zoom lenses are suited to situations where size and weight must be minimised, such as when shooting from the air.

> True macro lenses provide life-size (1:1) reproduction and are ideal for close-up shots of very small objects.
Many lenses are supplied with clip-on hoods, although some manufacturers only offer them as options with cheaper lenses in their ranges. Each hood is matched to a specific lens design so it’s important to get the correct model if you have to buy a hood for a particular lens. Hoods for telephoto lenses are usually cylindrical, while wide angle lenses have petal-shaped or box-shaped hoods.

Filter options for DSLR cameras are many and varied. Most lenses are threaded to accept screw-on filters and clip-on filter holders are also available (the Cokin brand being the most popular).

The most popular filters for digital photography include polarisers, graduates, soft focus filters and neutral density filters. Skylight and UV filters are unnecessary as all DSLR sensors are protected by a UV-blocking filter.

Polarisers are used for emphasising the blue of the sky, subduing reflections from water or glass and improving colour saturation. They are simple to use as they only need to be rotated until the desired effect is seen.

Graduated filters darken part of the picture – usually the sky. Available in several neutral density levels or in coloured form, they are often used for effect but can also help to turn a fairly ordinary shot into one with more impact. (Note: the Gradient filter in editing software can be used to achieve similar effects post-capture.)

Soft focus filters are used mostly in portraiture, where they subdue wrinkles and blemishes in the subject’s skin. Stronger filters can produce ethereal-looking landscape shots.

Neutral density filters reduce the amount of light entering the lens without changing its colour. They are used by photographers who want selective focusing or blurring due to long exposure times.

Add-on effects filters like star-burst filters are seldom used these days as many cameras provide in-camera digital effects. The same applies with colour filters for black-and-white photos.

Teleconverter and Extender Lenses fit onto the back of a normal lens and extend its focal length, usually by 1.5x or 2x. They’re an affordable way to achieve a longer focal length with a tele lens or convert a standard 50mm lens into a portrait lens.

However, they reduce the effective maximum aperture of the lens by the same multiplication factor. Fitting a 1.5x teleconverter to a 200mm f/2.8 lens will extend its focal length to 300mm but reduce its maximum aperture to f/4.

On the plus side, the close focusing distance of the original lens is retained, although image magnification is increased. Teleconverters are most suitable for focal lengths of 50mm and longer.
Using Legacy Lenses

Photographers who used to shoot film may have a suite of ‘legacy’ lenses, purchased with or for their film cameras. Many of these lenses can be used on modern DLSR bodies with the same mounts. Canon, Nikon and Pentax mounts haven’t changed since the days of film; Sony cameras can accept many Minolta lenses.

The mount in Olympus’s E-System (for the E-5) is not directly compatible with any OM Zuiko Olympus lenses, although Olympus offers an adapter that allows them to use used on modern cameras. Many legacy lenses will lack some or all of the electronic contacts that allow camera bodies and lenses to communicate so you may be forced to use manual focusing and exposure controls.

Because legacy lenses were designed for 35mm film cameras, when they’re mounted on a camera with a smaller sensor, the image will be cropped. This has the effect of extending the focal length by a ‘crop factor’ or ‘multiplier’ based on the sensor’s size.

With DX sensors, the crop factor is either 1.5x (Nikon, Pentax and Sony) or 1.6x (Canon). Olympus DSLR sensors apply a 2x crop factor. For example, a 50mm lens on a 35mm camera will have an effective focal length of 75mm on cameras with a 1.5x crop factor, 80mm on Canon’s DX DSLRs and 100mm on the Olympus E-5.

USEFUL URLs

CHAPTER 4
Basic Camera Settings

We’ll start this chapter with a tour around a typical DSLR camera, using cameras from three different manufacturers to illustrate the similarities and differences you can find in control layouts.

Front View

We’ve chosen a Sony DSLR as our example because it provides the key features of a DSLR without the moving mirror. This allows the sensor to be clearly seen. All sensors are covered by a low-pass filter that minimises the effect of aliasing (jagged edges produced by pixels).

This filter is also vibrated to remove dust that may settle when lenses are changed. In some cameras it is used as part of the image stabilisation system.

Surrounding the sensor bay is the lens mount, which is usually made from metal. A release button for detaching lenses can be located on either side of the lens mount but is usually on the left hand side.

The mode dial on the top panel of most DSLRs is the main tool for selecting shooting modes. It can be positioned on either side of the camera. In some professional cameras, shooting modes are set with buttons on the top panel.

A comparison of the mode dials on a professional DSLR (left) and an entry-level DSLR (right). (Source: Canon.)

Cameras that provide easily-accessed on-screen guides, such as the screens shown here from a Nikon DSLR, help novice users to master basic shooting techniques. (Source: Nikon.)
These cameras only offer four shooting modes: P, A, S and M.

Enthusiasts’ and entry-level DSLRs can provide as many as a dozen mode settings, with most including an Auto mode plus pre-sets for frequently used shot types (portrait, landscape, sports, etc). A few cameras include User or Custom settings where users can store frequently-used combinations of camera settings. Some provide a Flash-off mode that prevents the flash from popping up automatically in dim lighting. Some include the Movie mode on the mode dial.

Some entry-level DSLRs provide a Guide setting that provides instructions on using the shooting modes. In others, the guide simplifies the camera’s controls by allowing users to adjust camera settings based on pre-determined scenarios, such as distant subjects, close-ups of flowers, soft backgrounds, etc. Canon provides an A-DEP mode that sets the camera to record a wide depth of field in the shot.

The shutter release triggers the exposure. In some cameras it is surrounded by the power on/off lever switch. A control dial is usually located in front of the shutter release, where it is easily reached with the index finger. This dial can be used to adjust lens aperture or shutter speed settings, depending on the shooting mode selected.

**Back View**

The rear panel of all DSLRs is dominated by the monitor screen. Three-inch diameter screens are the norm these days, although some cameras have slightly larger ones. The screens in some cameras can be adjusted to allow the photographer to shoot with the camera held above the head or at waist level.

The higher the screen resolution, the clearer the image it displays and the more likely it is to provide an accurate representation of the scene’s colours. Unfortunately, all LCD screens can be difficult to ‘read’ in bright outdoor lighting. Brightness adjustments can go some way towards solving this problem but don’t overcome it (which is why you need a viewfinder).

Viewfinders come in two types: optical and electronic. **Optical viewfinders (OVFs)** use the camera’s lens to show you the scene in its natural colours and at high resolution. No lag time is involved, which makes them popular...
with sports and wildlife shooters. But in entry level DSLRs, the view can be cropped slightly and the camera will record a wider view of the scene that you see through the finder.

**Electronic viewfinders (EVFs)** take the signal from the camera’s sensor and display it on a tiny screen in the viewfinder housing. Viewing quality is highly dependent on the screen’s resolution and the camera’s image processing system.

Because you are viewing a video image, it can be made to fill the field of view and the camera can overlay the same data as you see on the monitor screen. You can also preview colour balance and exposure levels (via a histogram) as they will appear with the chosen exposure settings.

Most EVFs will brighten automatically in low light levels and many can enlarge the scene for focus checking. Removing the mirror also allows cameras with EVFs to support faster continuous shooting speeds than similar cameras with optical viewfinders.

Unfortunately, all EVFs suffer from delays as the screen is repeatedly refreshed. These lags can cause you to miss shots when photographing sports action. EVFs will also look jerky and grainy in dim lighting and they drain battery power.

**Arrow pads** come in various designs. Some are circular, while others consist of four buttons arranged in a cross. Both use directional buttons to access and adjust different functions, which are selected in the main **Menu** or via the **Quick menu** display.

More sophisticated DSLRs provide a second rear **control dial** wheel in addition to the front control dial. In
manual mode, one dial can be used to control aperture settings while the other is used for shutter speeds.

Buttons or levers for accessing the movie mode are included in most DSLRs. In some cameras, the movie button is on the top panel; in others, it’s on the mode dial. Canon’s lever selector has a central start/stop button for controlling movie recordings.

The Delete button and Playback button are self-explanatory. The Info button toggles through a sequence of data displays when images are played back.

Top View

The top panel contains the shutter release button, which is used to capture the shot. In many cameras, a power on/off lever switch surrounds it. Other buttons that can be located on this panel include buttons that provide direct access to exposure compensation, ISO, drive modes or dynamic range adjustments.

In cameras with built-in flashguns, the flash is housed above the viewfinder optics. It can be raised when required by pressing the flash release button, which is usually located on the left side of the housing. A hot shoe on top of the
flash housing allows users to fit external flashguns, which are often more powerful and adjustable than the camera’s flash. Most viewfinders provide dioptre adjustment that enables users who normally require glasses to adjust the finder to improve clarity. Adjustments can be via sliders or knurled knobs. Strap lugs are located on either side of the top panel to anchor the camera’s neck strap.

Image Quality

Even if you use your camera on Auto mode, it’s still important to select the correct image quality and size settings. Because changing these settings also changes the size of the pixel array that makes up the image and the amount of image data recorded, you need to know the effects of changing camera settings and whether to shoot JPEG or raw files.

The default file format in most cameras is JPEG. It’s the universal file format that can be displayed on any screen and opened with any image editor. Raw files contain image information directly from the camera’s sensor and require special software to open them and convert them into editable formats. (We’ll cover this topic in depth in Chapter 9.)

When files are saved as JPEGs, the camera compresses them to save space in its memory. In doing so, it discards image data – permanently. Most camera provide between one and three Quality settings that allow users to choose different degrees of compression for image files.

Information that is discarded in the compression process can never be retrieved, so choosing an appropriate image size and quality setting is an important consideration.

We normally recommend shooting with the largest image size and highest quality setting available. Memory cards are relatively cheap, even for high capacities so there’s no excuse for skimping to conserve camera memory. If you start with the maximum amount of image data there should be no visible quality loss when you make image files smaller for emailing or posting on websites.
<table>
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<tr>
<th>Scene Mode</th>
<th>What it Does</th>
<th>When to Use It</th>
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<tbody>
<tr>
<td>Portrait</td>
<td>Selects the widest practical lens aperture to blur the background. May enhance skin tones.</td>
<td>For selective focusing where you want to isolate a subject from a potentially distracting background.</td>
</tr>
<tr>
<td>Landscape</td>
<td>Sets focus to infinity and sets a small lens aperture. May increase sharpness and saturation and/or enhance blues and greens.</td>
<td>For distant subjects where maximum depth of field is required.</td>
</tr>
<tr>
<td>Sports/Action</td>
<td>Selects a fast shutter speed and wide lens aperture plus focus tracking (if available). May set high ISO value. Flash is activated if required.</td>
<td>For moving subjects.</td>
</tr>
<tr>
<td>Close-up</td>
<td>Sets the closest focus for the selected focal length. May also set high colour saturation.</td>
<td>For close subjects</td>
</tr>
<tr>
<td>Night Portrait</td>
<td>Sets a slow shutter speed and red-eye reduction flash (if available). May also enhance skin tones.</td>
<td>For shots of people after sundown, where a natural-looking balance between subject and background is required. A tripod may be needed to prevent camera shake.</td>
</tr>
<tr>
<td>Flash Off</td>
<td>Switches the flash to off and shooting mode to auto.</td>
<td>For available-light shots when flash is not wanted.</td>
</tr>
<tr>
<td>Children and Pets</td>
<td>Selects a fast shutter speed and high ISO setting to ‘freeze’ movement. Other controls remain automatic.</td>
<td>For fast-moving subjects when flash may be acceptable.</td>
</tr>
<tr>
<td>Beach &amp; Snow</td>
<td>Applies between +0.7 and +1.5 EV of exposure compensation</td>
<td>Prevents under-exposure in scenes with high brightness levels (beach and snow).</td>
</tr>
<tr>
<td>Sunset/sunrise</td>
<td>Boosts warm tones</td>
<td>When you want to emphasise the reds in sunset and sunrise shots.</td>
</tr>
</tbody>
</table>
Choosing the Right Shooting Mode

The mode dial is used for selecting the shooting mode and allows you to decide whether to rely on the camera’s auto exposure (AE) system or make use of manual controls. Setting the mode dial to **Auto** puts the camera into ‘point-and-shoot’ mode, effectively handing control to the camera’s microprocessor.

The camera sets the lens aperture, shutter speed, ISO and white balance to match the requirements of the scene it’s pointed at. Cameras with scene recognition algorithms can usually produce correctly-exposed photos in a wide variety of situations. But, they’re never perfect and at times you simply must control one or more parameters in order to obtain the shot you want.

In the ‘**P**’ mode (programmes auto exposure), the camera also determines optimal aperture and shutter speed settings for the subject. But whereas the auto mode limits the controls the photographer can access, the P mode will let you change either aperture or

Both the Auto and P modes should provide correct exposures for subjects with a relatively even distribution of tones within the frame, such as this typical landscape.
Camera Features

Most entry-level DSLRs – and some enthusiast’s models – include a number of pre-programmed aids that can make it easier for photographers to achieve particular objectives. Scene Pre-sets have been common for many years, both in point-and-shoot digicams and entry-level DSLRs. Their objective is to help novice users to choose the appropriate camera settings for different subject types.

The most common ones are portrait, landscape, sports, close-up and night portrait. Other modes may include: fireworks, sunset/sunrise, night scene, beach & snow or children & pets.

The table on page 40 shows how the more popular scene modes work and when to use them. Use them with discretion because some of the subsidiary adjustments (such as increasing saturation or boosting blue and green) may not be appropriate for your subject.

Custom Functions

Almost all DSLRs include one or more Custom functions covering key camera controls like focusing, exposures, image processing (noise reduction, lens corrections, etc.). A typical DSLR may have as many as 20 separate settings that are controllable through the Custom Function menu bank; professional DSLRs can have 60 or more.
Parameters that can be adjusted include allocating particular button controls to adjust settings like image size and quality, exposure compensation, image tone pre-set, exposure or flash adjustment, autofocus mode, or AF point selection. The Custom Function menu can also be used to set increments for exposure adjustments, switch noise reduction on and off and/or control the level of noise reduction processing.

Other Custom Functions may include controlling the flash synchronisation speed, AE and AF lock functions, AF assist beam, flash metering, shutter curtain synchronisation for flash shots and ISO setting increments. Mechanical controls like mirror lock-up (for very long exposures), are usually covered in the Custom Function menu, along with power management and LCD display settings.

Bracketing settings for exposure, focusing and white balance can also be found in the Custom menu. Extension of the ISO sensitivity range may also be provided as well as controls for matching the image sensor and processing control to a selected lens. For professional DSLRs that accept interchangeable focusing screens, the correct Custom Function must be set to match the exposure correction to the screen in use.

It is worth reading through your camera’s instruction manual to see which functions can be adjusted through the Custom Function menu. Check the default settings to ensure the camera is adjusted to meet your own requirements before you embark on a shoot.
Colour Space Settings

The colour space setting on a digital camera delineates the range of colours it can reproduce. The default setting on all digital cameras is sRGB, which covers the colours that can be displayed on a computer or TV monitor. All DSLRs offer an additional colour space setting, known as Adobe RGB, which can record a wider range of hues and tones (see diagram).

Professional photographers sometimes use an even wider colour space, ProPhoto RGB. But only the most sophisticated camera sensors can record its full colour gamut.

Landscape photographers who plan to print their best shots usually find the Adobe RGB setting gives them more colour information to work with and produces prints with a wider colour and tonal range. It’s also suitable for photographers who like to shoot raw files and edit them before making prints.

It’s less relevant for portraiture and many entry-level and multi-function printers can’t reproduce all the Adobe RGB tones. The default sRGB colour space setting suits everyday photography and should be used for shots that are destined for online applications (emails and websites) and photos that will be displayed on a TV screen.

USEFUL URLs

- http://www.bythom.com/you.htm for general advice on getting more from your photography.
Serious photographers usually prefer working with the A, S and M shooting modes because they provide full control over exposures. They also allow full access to all camera settings (except exposure compensation in M mode). Each shooting mode is useful in different situations.

In the A (aperture-priority auto exposure) mode, the photographer sets the lens aperture, leaving the camera to set the shutter speed. This mode is used to control how much of the scene is in sharp focus and which parts of the subject are sharply focused.

Wide apertures (denoted by low f-numbers such as f/1.8 to f/4) produce a shallow plane of focus, which is ideal for portraiture. Small apertures (such as f/11, f/16 or f/22) make everything sharp from close to the camera to the horizon, an advantage for landscape photography.

When using this mode, be sure to monitor the shutter speed setting (shown in the viewfinder) as small apertures will usually be associated with slow shutter speeds. You may need to increase the ISO value to compensate and bring the shutter speed back to a level where hand-holding the camera is possible. Alternatively, mount the camera on a

Nikon’s entry-level DSLRs provide on-screen guides to the effects produced by aperture adjustments. (Source: Nikon.)

Closing the lens aperture down to f/16 ensured details in both the foreground and distant parts of the scene would be sharply focused.
tripod to prevent camera shake from spoiling the shot.

The S mode (shutter-priority auto exposure) lets you select the shutter speed you need, leaving the camera to set the lens aperture. It’s ideal for action shots because you can set a fast shutter speed to ‘freeze’ movement and also useful when shooting with a long telephoto lens because you can set a fast enough shutter speed to minimise the effects of possible camera shake.

Another application for the S mode is when you want to create intentional blurring in shots of moving subjects, such as flowing water. Slow shutter speeds (one second or longer exposures) allow you to achieve this effect.

Shutter speeds of between 1/30 and 1/60 second are ideal for panning, when you move the camera in synchronisation with the subject’s movement. This blurs the background (and stationary objects in the foreground), effectively isolating the subject.

The M (manual) mode gives photographers independent control over both aperture and shutter speed. Check

![Image of dancers performing] The manual mode allows you to set the lens aperture and shutter speed separately. It’s useful in difficult lighting, as shown here, because you can match the controls to the subject requirements. In this case, a fast shutter speed was combined with a wide lens aperture and high ISO setting to capture action in low light levels.
the exposure values in the viewfinder display when using this mode to ensure your shots aren’t over- or under-exposed.

The manual mode provides total exposure control and is useful when you want to create special lighting effects. The manual control only applies to exposure values; autofocusing remains active in this mode when it is selected.

Canon adds an A-DEP shooting mode, which stands for Automatic Depth of Field. It’s designed to record a wide depth of field in the shot. All the autofocus (AF) sensors will be used to detect the subject and the lens aperture will be set to make the key subject elements appear sharp. If flash is used with this mode, the results will be the same as obtained with the P mode plus flash.

Pentax cameras include an Sv setting, which allows users to prioritise the ISO value, while the camera sets the aperture and shutter speed. It’s used when there’s a risk of noise interference at high sensitivity settings, although many cameras support ISO limitation (which achieves the same objective) in their normal or custom menus.

The TAv mode (shutter and aperture priority) is also unique to Pentax cameras. It allows users to specify both the aperture and shutter speed and have the camera adjust the ISO sensitivity.

A fast shutter speed of 1/1000 second plus a 300mm lens were used to ‘freeze’ action in this shot.

A few cameras include a Flash Disabled mode that prevents the flash from popping up and firing in poorly lit conditions. A tripod will be necessary when a slow shutter speed is selected.

The C series modes are Custom User modes that allow users to register a collection of preferred camera settings for different shooting situations. Parameters that can be registered include the shooting mode, menu settings and any custom function settings used. These modes are handy time-savers for photographers who shoot a lot of pictures, such as portraits or landscapes, in similar conditions because they can simply select the appropriate custom mode and know their camera will require only minimal re-configuration.
Exposure Metering

Aside from the M shooting mode, exposure determination is largely automated in modern cameras. Exposure meters are used to measure the tones in the subject according to a selected pattern. Understanding how metering patterns work will help you to decide which one to use in different situations.

Three metering patterns are available in DSLR cameras: multi-pattern evaluative (or matrix), centre-weighted average and spot. Selecting the correct pattern for the subject makes it easier to obtain the correct exposure settings.

**Multi-pattern metering** divides the subject area into multiple segments and individually evaluates the light levels within each segment. A basic pattern contains between five and seven segments, as shown in the illustration on this page. More complex systems use hundreds of segments and some cameras can integrate colour and/or distance information from the image sensor to improve the accuracy of exposure measurements.

The microprocessor in the camera takes the readings from each segment and biases them according to the difference in overall brightness (and often contrast) within each segment and between adjacent segments. It then calculates which aperture and shutter speed settings will deliver an optimum exposure.

Multi-pattern systems are good all-rounders, providing optimal exposure settings for most types of scenes (including backlit subjects and landscapes with large areas of sky). However, because they deliver an
‘averaged’ exposure setting, they may not suit some subject types.

**Centre-weighted average metering** integrates readings from all over the field of view, placing more emphasis on the centre of the field. It’s effective for subjects with an average brightness range where the main area of interest is central.

This system can fail when you’re shooting bright, contrasty scenes with sand or snow or low-contrast subjects with a limited tonal range. In bright conditions, there’s a tendency towards underexposure, while poorly-lit subjects with a reduced brightness range are often over-exposed.

Spot metering takes a single reading from a small section of the field of view. In most cases, the size of the spot is expressed as a percentage of the field of view, with typical spot sizes ranging from 1% to about 4%. So-called partial metering systems have slightly larger metering areas but work on the same principle. Because areas outside the selected spot are ignored, spot and partial metering are ideal for backlit subjects.

To use a spot meter, simply centre the spot on the area you want to measure and press the shutter release half way down. This locks the exposure (and focus), allowing you to re-compose and take the shot by pressing the shutter all the way down.

A spot meter can also be used to gauge the brightness range in the subject. Simply measure the brightest and darkest areas and calculate the number of stops between them. These factors make multiple spot metering the best option for digital photographers when shooting wide brightness range subjects.

**Chimping**

This colloquial term refers to the practice of checking shots on the LCD monitor immediately after they have been taken. Some photographers use it in a
derogatory sense but many experienced photographers know its value.

The practice has benefits and disadvantages, as outlined below. The main benefit is that it’s a quick and easy way to check focus and exposure in shots. This allows you to delete unsatisfactory shots and free up space on the camera’s memory card while you’re on location. But it has a few downsides.

Chimping takes your attention away from the action and interrupts your communication with your subject.

While you’re looking at the last shot you can miss photo opportunities, particularly when the action is fast-paced.

Even in relatively low light levels, LCD monitors rarely display the full depth of tones in images and you may miss blocked-up shadows or blown-out highlights. Colour fidelity may also be relatively poor, particularly with low-resolution displays.

In bright outdoor lighting, the view is often too poor to make useful evaluations.

As a general rule, chimping can be useful if you have time. But you need to use the histogram (see box) to evaluate exposures, rather than relying on what you see on screen. And you should NEVER chimp if it would interrupt a shooting sequence.

Chimping, or replaying the shot you’ve just taken to check focus and exposure, allows you to delete poor shots on the spot.
Using a Histogram

The histogram display can provide a useful guide for setting exposures because its shape reflects the tonal distribution in your subject. When the graph encompasses the entire scale without showing high peaks at either end, the photograph has recorded the full subject tonal range and highlight and shadow areas should contain detail.

To avoid blown-out highlights, make sure the graph does not build up at the right hand end of the scale. To avoid blocked-up shadows, try to keep the graph low at the left hand end of the scale.

In this image, the subject tones are skewed towards darker values, as indicated by the left-biased distribution on the graph.

The histogram for this image, which has a limited brightness range, shows subject tones are evenly distributed around the middle of the brightness scale.

The predominance of light tones pushes the histogram for this image strongly to the right end of the graph.
Exposure Compensation and Bracketing

All cameras provide an exposure compensation (+/-EV) setting that lets photographers adjust exposures when the metering system fails to provide correct exposure levels. (Flash exposure compensation is also available for adjusting flash output levels.)

Exposure compensation settings use a sliding scale that normally runs from three f-stops of under-exposure to three stops of over-exposure. More sophisticated cameras cover a wider range of settings.

When the exposure value (EV) is set at zero, the metered exposure value is used. Adjusting the slider makes each picture you take darker (minus values) or lighter (plus values).

To prevent highlights becoming overexposed in outdoor lighting, many digital photographers set the exposure compensation on their cameras to -0.3EV to increase the chance of capturing highlight details. This strategy works best when you shoot raw files because they can be processed to recover details from a wider tonal range than JPEGs provide (more on this topic in Chapter 9).

For beach and snow scenes with large, highly-reflective areas in the subject, the camera’s metering system can be overwhelmed by the excessive brightness and may under-expose shots, often quite severely. To compensate, set the exposure compensation to +0.3EV or as high as +1.0EV in very bright conditions.

The technique of bracketing involves taking a series of shots with slightly different camera settings from those determined by the camera’s automatic measurements. The most commonly used setting is auto exposure bracketing (AEB), which involves changing the exposure level across a pre-set exposure range (usually from one to two f-stops of under-exposure to the same amount of over-exposure).

The normal practice is to take between three and five shots, with the middle shot at the metered value and the others above and below it. This basic strategy is a kind of ‘insurance policy’ for obtaining a correct exposure because it ensures a chance at least one of the three shots will be correctly exposed.

It doesn’t matter which order you take the shots in; nor does it matter whether you take three or five – or even more exposures. The amount of over- and under-exposure can often be specified in the setup menu and the midpoint can be specified anywhere within the bracketing range. You can normally bracket shots across the same range of exposure levels as the camera’s exposure compensation range.

Other functions that can be bracketed include white balance, flash exposure and focus. White balance bracketing is
These images show the effect of in-camera dynamic range adjustments. The image on the left is captured without adjustment, while the one on the right has received a high level of in-camera processing.

used to obtain better colour accuracy in mixed lighting. It normally uses in-camera processing to change colour balance across two axes: amber/blue and magenta/green.

Flash bracketing is like exposure bracketing for flash but normally adjusts the flash output without changing the camera’s exposure settings. It’s limited with on-camera flashes because of the delays associated with power recycling. Focus bracketing involves making small changes to the focus position. Depth of field bracketing is similar but adjusts the lens aperture instead. Both are most useful for macro photography, where they can provide a useful way to ensure key parts of the subject appear sharp.

Other bracketing options include ISO bracketing, which is comparatively rare. More common in entry-level cameras is effects (picture style, digital filters) bracketing, which lets camera users select the best effect from a series created in the camera from a single JPEG shot.

Dynamic Range Adjustments

While human vision can see a very wide range of tones, all cameras have problems recording subjects with an extremely wide brightness range. This has led manufacturers to introduce
dynamic range compensation, which compresses both the brightest and darkest tones in the scene until they fit within the sensor’s recording range.

Dynamic range adjustments are only applied to JPEGs; raw files record more image data and provide greater scope for ‘developing’ highlights and shadows in images (more on this topic in Chapter 9).

The in-camera adjustments use algorithms to ‘map’ tones differently in highlight and shadow areas, pulling them back into the range of tones the sensor can record – and a monitor can display. The result is more even exposure with increased detail in the highlights and shadows.

The success of these systems depends on how much the tones in the original scene are compressed and the quality of the compression algorithms. They work best on images with brightness ranges that don’t greatly exceed the sensor’s capabilities. Images with very wide brightness ranges can end up looking unnatural and over-processed, as shown in the illustration on this page.

Some photographers like the effects produced by dynamic range processing and most image editors include HDR (High Dynamic Range) blending modes that can combine sequences of shots taken with different exposure values into a single image with an expanded dynamic range. (AE bracketing can be used to capture the shots.)

An example of an image with a wide brightness range that has been over-processed through use of a strong dynamic range adjustment setting.

USEFUL URLs
The following websites provide additional information on the topics covered in this chapter.

When you take a picture, you’re juggling three camera settings: the lens aperture, the shutter speed and the ISO setting. You may also need to adjust white balance (which controls colour rendition). We’ve looked at the effects of aperture and shutter speed controls in Chapter 5. In this chapter we’ll consider sensitivity (which is determined by ISO settings) and white balance.

The ISO setting adjusts the sensor’s sensitivity to light, thereby determining the amount of light required for a correct exposure. At the same time, it influences the ratio of signal (image data) to electronic noise that is recorded in the image.

Back in the days of film, the sensitivity of the recording medium was set when the film was loaded; with digital, it can

When you’re hand-holding the camera in poorly-lit indoor environments, raising the ISO to 1600, as happened for this picture, can dramatically reduce the chance of camera shake blurring the photo.
be changed on a shot-to-shot basis. Understanding ISO will help you to set your camera correctly for optimal exposures. And that will lead to better pictures.

**Exposure Balancing**

The ISO setting is used in the same way as the aperture and shutter speed settings. If you increase the ISO by one EV (exposure value), for example by moving from ISO 100 to ISO 200, the camera’s sensor needs only half the amount of light for the same exposure.

Suppose your camera set a shutter speed of 1/30 second at ISO 100 and you felt you couldn’t hand-hold the camera at such a slow shutter speed; increasing the ISO setting to 200 would give you a shutter speed of 1/60 second (assuming the aperture is unchanged).

In practice, you need to balance shooting convenience against potential for noise when adjusting ISO settings. Choose a low ISO whenever you can – including long exposures. But be prepared to increase the camera’s sensitivity when conditions demand it, taking into account the potential for noise in the resulting shot.

Adjusting ISO settings is wise when you’re shooting at low light levels and need fast shutter speeds to record action. In such a situation, boosting the ISO setting to 1600 would enable you to use a shutter speed of 1/500 second, which would be fast enough to stop action when photographing indoor sports.

DSLR cameras vary in the range of ISO adjustments they permit but all support a range of ISO settings between ISO 200 and ISO 6400. Many extend that range down to ISO 50 and up to ISO 25600 – or higher. Most DSLRs allow photographers to adjust ISO settings in 1/2 or 1/3 step increments, with settings usually provided in the Custom Function menu.

Almost all DSLRs also include an Auto ISO setting, which allows the camera to determine the optimum ISO setting for the subject. Most allow photographers to set an upper limit to the Auto ISO range, either in the main camera menu or as a Custom Function.

Limiting ISO is useful in shutter-priority AE mode for preventing the sensitivity from being pushed to a level that may result in noise in the image.

Most DSLRs enable users to set a maximum limit beyond which sensitivity will not be increased. (Source: Canon.)
result in image noise (see above), which increases when the signal from the sensor is boosted.

Suppose you’re shooting a basketball match and using shutter speeds of, say, 1/250 second, it’s usually wise to set the camera to limit the sensitivity to, say, ISO 3200 to keep noise below noticeable levels. When the light level in the scene is bright, the ISO value is lowered automatically.

When the camera’s exposure meter detects low light levels, the camera will automatically kick up the ISO to maintain that shutter speed. But it won’t go above ISO 3200, regardless of ambient light levels.

Image Noise

Photographers typically recognise three types of image noise: fixed pattern noise, random noise and banding noise. Fixed pattern noise is associated with long exposures and high temperatures. It usually appears as ‘hot pixels’ which show up as white or coloured blocks.

Random noise is also granular, often appearing as a ‘salt-and-pepper’ pattern with dark pixels in bright regions and bright pixels in dark regions. It usually occurs with high ISO settings. Banding noise appears as stripes and is introduced by the camera when it ‘reads’ data from the image sensor. (Banding noise is rare with modern DSLRs.)
Noise not only changes with exposure settings and camera models, it can also vary within an image. Shadowed regions usually contain more noise than highlights.

Cameras with large sensors that have big pixels can collect more light and are, therefore, less susceptible to image noise than small-sensor digicams with high pixel densities. This is the main reason DSLRs deliver better performance at high ISOs than compact cameras.

Most sensors are designed to work best between ISO100 and ISO 200. However, when you use a modern DSLR camera, noise is seldom visible unless you shoot with ISO settings above 6400 – and even then, it may only be seen when the image is enlarged substantially.

**Noise Reduction**

Because all pixels collect some noise, all cameras perform some level of noise-reduction processing on the JPEG files they produce. Sometimes it’s applied automatically; at other times at the user’s discretion.

More sophisticated cameras provide separate processing settings for long exposures and high sensitivities. Newer cameras use newer technology and can deliver images with less noise at similar ISOs than earlier cameras could achieve.

Long-exposure noise reduction usually involves a technique known as ‘dark frame extraction’, which is applied automatically in many cameras for exposures longer than one second. The camera records the scene and then takes a second exposure of the same length with the shutter closed to capture the noise pattern produced by the sensor. The noise pattern is mathematically subtracted from the image, leaving it virtually noise-free.

While dark frame subtraction...
effectively removes most of the noise created during long exposures, high ISO noise-reduction processing tends to work by blurring the edges of noise patterns and this can reduce the sharpness of images. Photographers are faced with choosing whether sacrificing some real detail is acceptable if it allows more noise to be removed.

Processing technologies work on two main types of noise. Luminance noise consists mostly of variations in brightness patterns. Chrominance (or colour) noise appears as coloured speckles. The aim is to identify the type of noise and apply the right amount of processing to minimise it.

We tend to find colour noise more objectionable than luminance noise so most cameras apply more noise reduction to it. When images are edited, most software allows the user to control colour and luminance noise reduction separately.

Dark frame subtraction is used to suppress noise in long exposures. But it can tie up the camera for long periods of time. A 35-minute exposure to record star trails as streaks locked the camera for 70 minutes to allow noise reduction processing.
Using High ISO Settings
The effect of image noise depends on how images are viewed and we can often live with images that contain some visible noise, whereas images blurred by excessive noise-reduction processing become unattractive. Noise is usually more obvious when images are displayed on-screen than when they are printed.

Although noise will become more noticeable when images are enlarged and cropped, if noise-affected images are printed at large output sizes, the noise may not be noticeable when the prints are viewed from the appropriate distance. (Printing converts pixels into dots, blurring the edges between them.)

High temperatures can boost image noise so it pays to be cautious about using the top ISO values when the temperature is above about 20 degrees Celsius. Combining high ISO settings with long exposures at temperatures of 30 degrees Celsius and above is virtually certain to produce noise-affected photos.

White Balance
The white balance setting is used to make the colours in a digital photograph look natural under different lighting conditions. It works by adjusting the colour balance so that objects which appear white in reality are rendered white in the image. To do this, the camera has to evaluate the ‘colour temperature’ of the light illuminating the subject and correct for its relative warmth or coolness of white light.

Human eyes are very good at judging what is white under different light sources and our brains apply automatic correction to produce a colour-correct impression. Digital cameras have to rely on auto white balance (AWB) adjustments, which can often fail — and may even introduce unwanted blue, orange or green colour casts.

AWB adjustment balances the colour data from the camera’s red, green and blue (RGB) channels. These primary colours are found in all light sources in varying proportions, depending on the colour temperature of the light source. With a high colour temperature, the light has more blue; with a low colour temperature it’s redder.

Different types of lighting have different colour temperatures, which allows camera manufacturers to create a range of pre-set colour balances that should, in theory, counteract the colour cast and restore cast-free colours. The illustrations
Typical colour corrections applied by white balance presets. Top row from left: Auto white balance should reproduce natural colours with no obvious bias; Daylight correction adds a touch of orange to counteract the blue from cloudless skies; Shade correction intensifies the orange correction. Middle row from left: Flash correction adds a hint of yellow to remove a slight blue bias in electronic flash light; Daylight Fluorescent lamps require a fairly strong orange-red correction to counteract strong blues in their emission; Cool White Fluorescent lighting needs a slight magenta bias to remove greenish casts. Bottom row from left: Warm White Fluorescent light is biased towards red and orange and needs a blue filter to correct it; Incandescent lighting is very orange and is corrected by a strong blue filter; Cloudy skies need a hint of yellow to warm a slight blue cast.

In most DSLRs, photographers can set white balance relative to the Kelvin colour temperature scale. This can save time when shooting with standardised lighting as you can simply dial in a correction to match the lights you use. The table on the following page shows the Kelvin temperatures for some frequently-used lighting types.
Most types of natural lighting (and some artificial light sources) involve a range of Kelvin values, which means the actual colour may fall anywhere within the specified range. Some types of artificial lighting, notably fluorescent lighting, are ‘spiky’, with stronger emissions at specific colours.

The Kelvin values for fluorescent lighting vary according to the different types of fluorescent tubes on sale: daylight, warm white and cool white being the most common. This can make correction of colour casts tricky.

The colour bias of a clear blue sky or open shade can be influenced by the latitude where the photograph is taken. Kelvin values are usually higher in higher latitudes and some degree of fine-tuning may be required.

To overcome problems associated with varying colour balances, all DSLRs provide a manual or ‘custom’ setting, which lets you measure the colour of the illuminating light and use the result to remove unwanted colour casts. The process is straightforward. Simply cover the subject with a plain white object (sheet of paper or white card) and set the lens focus to manual before taking an exposure or white balance reading to capture the colour of the illuminating light. (Some cameras can record the light without taking the shot.)

Success depends on the initial exposure, which captures the colour data. If it’s not correct, subsequent shots may be off-colour. Some cameras alert photographers when this happens – but most don’t so you should always check your shots when using this strategy.

Shooting raw files (see Chapter 9) is the best way to deal with white balance in difficult lighting because you can

<table>
<thead>
<tr>
<th>Type of Light Source</th>
<th>Kelvin Temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sunrise or sunset</td>
<td>2000-3000K</td>
</tr>
<tr>
<td>Household incandescent bulbs</td>
<td>2500-2900K</td>
</tr>
<tr>
<td>Photographic tungsten lighting</td>
<td>3000K</td>
</tr>
<tr>
<td>Halogen lights</td>
<td>3200-3500K</td>
</tr>
<tr>
<td>Fluorescent lights</td>
<td>3200-7500K</td>
</tr>
<tr>
<td>Mid-afternoon sunlight</td>
<td>4500-5000K</td>
</tr>
<tr>
<td>Average noon daylight</td>
<td>5500K</td>
</tr>
<tr>
<td>Sun through clouds or haze</td>
<td>5800-6500K</td>
</tr>
<tr>
<td>Overcast sky</td>
<td>6000-7500K</td>
</tr>
<tr>
<td>Open shade</td>
<td>6500-8000K</td>
</tr>
<tr>
<td>Clear blue sky (without direct sun)</td>
<td>10,000-16,000K</td>
</tr>
</tbody>
</table>
The Standard, Neutral and Faithful image tone adjustments all produce natural looking colours.

adjust white balance AFTER shots are taken. Raw files also provide a broader range of colour temperature adjustments, which may been needed to cope with subjects containing a mixture of different lighting types (fluorescent, halogen and incandescent, for example).

Adjusting white balance in a raw file is quick and easy. You can either tweak the temperature and green-magenta sliders until colour casts are removed, or simply click on a neutral colour (white or grey) within the image. This reference can be used to quickly correct other shots taken under the same lighting.

Image Tone Adjustments

Most DSLRs include special image tone adjustments (or ‘picture styles’) for

The Monochrome setting converts the colour image into black and white.

On-screen adjustments of colours along Blue/Amber and Magenta/Green axes are available in all DSLR cameras for fine-tuning colour balance settings.
COLOUR

Examples of some of the digital filter effects provided in many modern DSLR cameras. Top row: the unedited image, Toy Camera, Grainy B&W; bottom row: Reversal Film, Miniature, Bleach Bypass.

As a rule, these controls can only be used in the P, A, S and M shooting modes and only with JPEG files.

It’s common to have a Standard default setting plus presets for Vivid, Neutral, Portrait, Landscape and Monochrome. Most cameras allow users to adjust the sharpness, contrast, colour saturation and colour ‘tone’ (or hue) parameters within each setting.

Sharpness adjustments work mainly on edges and allow photographers to sharpen or ‘soften’ their shots. Contrast and saturation (colour vividness) adjustments are similar, with the minus settings reducing and the plus settings increasing the selected parameter.
Picture style adjustments can often be applied post-capture when converting raw files into editable formats. Some cameras also allow them to be applied in-camera (to JPEGs) and a few allow users to save adjusted settings as new picture styles for future use.

**Digital Filter Effects**

Digital filter effects have become popular in recent times, particularly in entry-level cameras. They’re usually accessed through the main menu and typically include Toy Camera, Retro, Miniature, Reversal Film, Monochrome and Bleach Bypass settings. These effects can only be applied to JPEGs and some are quite extreme. Different manufacturers provide different levels of adjustment for these effects.

The main problem with all of these adjustments is that the adjusted settings are locked into the image file. The adjustment range is also somewhat limited, compared with the adjustments available in image editing software – including raw file converters. We suggest that you use them sparingly.

Make sure you keep an unadjusted copy of the shot by shooting RAW+JPEG pairs. Then, if you don’t like effect, it’s easy to go back to the unadjusted image and start again.

**USEFUL URLs**

CHAPTER 7

Focusing and Depth of Field

Smart autofocusing can mean the difference between a usable image and a missed opportunity that will be discarded. Focusing also influences depth of field: the range of distance within a scene that appears acceptably sharp.

Depth of field varies depending on camera type, aperture and focusing distance and can also be influenced by the image size and viewing distance.

It doesn’t change abruptly from sharp to unsharp, but instead occurs as a gradual transition.

Your choice of lens aperture controls how wide the area of acceptable sharpness is. Wide lens apertures will produce shallow depth of field, while small apertures can make everything appear sharp from close to the photographer out to the horizon.

Depth of field in an image is greatest with small lens apertures, wide angles of view and distant subjects.
When the subject occupies the same percentage of the image for both a telephoto and a wide angle lens, the depth of field in each picture will remain virtually constant. However, the zone of decreasing sharpness in front of and behind the focused distance will change with focal length, becoming less as the focal length becomes longer.

The table below shows how the depth of field changes as focal length increases for a subject at 10 metres from the camera with a lens aperture of f/2.8. This explains why it is critical to focus precisely with telephoto lenses.

### How Cameras Autofocus

Most photographers use two types of focusing, manual focusing in which the photographer focuses on the subject by turning the focusing ring on the lens and autofocusing (AF), where the camera focuses on the subject. Just about everyone relies on the latter because all cameras provide it. In DSLR cameras AF systems are generally fast, effective with most subjects and easy to use.

Two types of AF systems are common in DSLR cameras: phase-detection and contrast detection. Phase detection

<table>
<thead>
<tr>
<th>Lens focal length (DX cameras)</th>
<th>Dispersal of Depth of Field</th>
<th>Total Depth of Field</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Closest acceptable sharpness</td>
<td>Furthest acceptable sharpness</td>
</tr>
<tr>
<td>18mm</td>
<td>3.55 metres</td>
<td>infinity</td>
</tr>
<tr>
<td>25mm</td>
<td>5.15 metres</td>
<td>171.16 metres</td>
</tr>
<tr>
<td>55mm</td>
<td>8.38 metres</td>
<td>12.51 metres</td>
</tr>
<tr>
<td>100mm</td>
<td>9.45 metres</td>
<td>10.62 metres</td>
</tr>
<tr>
<td>200mm</td>
<td>9.86 metres</td>
<td>10.15 metres</td>
</tr>
<tr>
<td>300mm</td>
<td>9.94 metres</td>
<td>10.06 metres</td>
</tr>
</tbody>
</table>

Depth of field is reduced in close-up shots, with narrow angles of view and when wide lens apertures are selected.
FOCUSING

systems work by dividing the incoming light into pairs of images and comparing them. The system uses two optical prisms which capture the light beams passing through opposite sides of the lens.

A beam-splitting, semi-transparent mirror (or a semi-transparent area on the main reflex mirror) directs these beams down to an AF sensor, which is usually located below the mirror. The two images are then analysed to find similar waveforms. The phase difference between the two images is used to determine how much the lens elements should be moved and in what direction, as shown in the diagram below. The lens motor will then move the optical components to provide correct focus.

Contrast-based AF systems rely on measuring the intensity difference between adjacent pixels on the AF sensor. This intensity difference reaches a maximum when the lens is correctly focused. Although only used for the Live View mode in DSLRs, contrast-based AF systems are common on digicams and video camcorders.

They tend to be slower than phase-detection systems because they must drive the lens back and forth to find the position with greatest contrast. Phase-detection systems calculate the distance to the focus point and move the lens directly there.

The illustration above shows how the imaging light path is split in a DSLR camera to direct light to a beam-splitting sensor that measures how the lens elements should be moved to focus on the subject.
The diagram above shows the locations of the hybrid area (which contains phase-detection sensors) with respect to the full image area in a typical camera.

As the focusing elements in the lens (simplified here) are moved, the signal reaching the line sensor varies and this is used to control the direction and degree to which the lens elements must be moved to achieve sharp focus.
Both systems can fail when contrast is low. They can also fail in dim lighting or when the subject contains large areas of a single colour (sky, wall, etc.). Many cameras include an AF illuminator to overcome such problems, although it will only work with relatively close subjects.

**Hybrid AF Systems**

Hybrid autofocusing systems, as the name implies, combine phase-detection and contrast detection. They were first introduced by Fujifilm in a compact digicam, the FinePix F300EXR but other manufacturers, including Canon, Nikon and Sony have adopted the technology to provide faster focusing in the live view mode for their latest DSLR cameras.

The system requires an array of phase-detection sensors to be embedded in the surface of the camera’s sensor chip. (In Sony’s SLT-A99 there is already a phase detection module in the camera; adding phase detection sensors to the imager increases the speed and accuracy of the camera’s AF system in live view mode.)

**How Many AF Points?**

The camera’s AF area points are arranged in arrays within the image frame. Different cameras have different numbers of points and different array patterns.

Each AF array measures relative focus by evaluating local changes in contrast. The highest contrast is assumed to correspond to maximum sharpness.

The robustness and flexibility of autofocus is largely controlled by the number, position and type of points in each camera’s array. In general, the more AF points a camera has, the more sophisticated its AF system.

Two types of sensors are used in these arrays: linear and cross-type. Linear sensors can only detect contrast in one direction so, when they are used, some sensors may be orientated vertically, while others are horizontally aligned. This arrangement detects contrast in both directions.

Cross-type sensors have both horizontal and vertical detectors and
Spot autofocusing allows you to focus precisely on the area you wish to render with maximum sharpness.

can pick up contrast differences in both dimensions, making them more sensitive and more accurate. The more cross-type points there are, the faster and more accurate a camera’s AF system can be.

Multiple AF points can work together for improved reliability, or in isolation for improved precision, depending on the camera setting. The number and accuracy of the AF points selected in multi-AF modes can vary with the maximum aperture of the lens.

A central cross-type sensor can reduce focusing time for subjects in extreme defocus when using a lens with a maximum aperture of f/2.8 or brighter. When the maximum aperture of the lens is f/5.6 or smaller (a common situation for fast telephoto and long zoom lenses), surrounding AF points may be needed to focus the lens.

AF Point Selection

Most DSLR cameras allow photographers to choose which one of an array of focus points the camera will use for focus and exposure determination. The number of points varies, with some cameras offering three selectable points, others five and yet others nine – or more. In some cameras, groups of AF points can also be selected. Selected points light up in
FOCUSING

the viewfinder to show photographers which are in use.

Another way to select a limited range of AF sensors is to use the Spot AF mode. This focuses the camera on a small spot in the centre of the viewing screen. It is used when precise focusing is required. Unlike the AF point selection setting, this mode always focuses in the centre of the frame.

In cameras with touch screens, touch AF/touch shutter controls makes selective focusing very easy. Touching a point on the screen causes the camera’s lens to focus on that area in the scene. When touch shutter is enabled, the shutter will be triggered once focus is achieved.

AF Modes

The most widely supported AF mode is one-shot focusing, which is best for still subjects. In this mode, pressing the shutter release half-way down activates the autofocus and achieves sharp focus only once. The focus is retained while the shutter button is held down, allowing the photographer to re-compose the shot while maintaining the initial focus.

For moving subjects, most DSLRs include a continuous AF mode (also known as AF Servo). It adjusts the focus distance by predicting where the subject will be, based on estimates of its speed, and measured by continuously re-focusing. This setting improves your chances for getting sharp focus with moving subjects – provided they’re not moving too quickly – but constant re-focusing consumes more battery power than the single AF mode.

Tracking AF is a development of the continuous AF mode. It locks on to the subject when the photographer half-presses the shutter button and

One-shot AF is ideal for still subjects, like landscapes.
determines its speed and direction of motion. A servo feedback mechanism allows the system to predict where the subject will be when the shutter button is pressed all the way down.

A signal – in the form of a confirmation light or beep – indicates when focus is achieved. Note: for subjects to be sharp you need to track the subject for a second or two before taking the shot.

Predictive AF is very effective for photographing subjects moving at a constant speed toward the camera. It can maintain accurate focus even when the subject is moving fast. If your target momentarily passes behind an obstruction, most cameras will hold and recapture the focus when the target emerges again.

Finding focus is more difficult when subjects are moving quickly across the photographer’s field of view. In such cases, cameras that offer Zone AF (which lets you select a group of AF points, either in the centre of the frame or off-centre) can make it easier to capture panning shots like the example shown on this page.

In addition to Zone AF, most cameras provide users with a selection of AF area options. When the one-shot AF mode is selected, all sensor points are available and the camera will choose the ones that can focus on nearest subject with adequate detail.

In spot AF mode, a single sensor point is selected. The default is the centre.

This sequence of frames shows how the focus is passed from one point to the next in the AF point array in AF tracking mode as the subject’s position in the frame changes. (Source: Canon.)
FOCUSING

Point but most cameras allow users to select any one AF point and keep it on the subject.

AF Point Expansion, which is provided on more sophisticated cameras, adds several surrounding points providing a larger, moveable cluster of active AF points. This setting is especially useful if the central point in the cluster suddenly detects part of the subject with little detail or contrast.

The one-shot AF mode will usually focus quickly and accurately. Once you’ve acquired the target with the central sensor, the camera will pass it to other points automatically as the subject moves and, should it lose lock, it will attempt to guess where the subject is for about a second before starting to hunt for it.

Hunting drives the focusing elements back and forth within the lens barrel, searching for a high-contrast edge to lock onto. In poor lighting and when busy background or foreground items are included in the frame, the AF system can take several seconds to find the subject again.

Such delays can cause you to miss shots. When they occur, it’s time to turn to manual focusing.

Manual Focusing

Focusing manually can often be quicker than autofocusing, particularly when subjects are moving rapidly either towards or away from the camera. It
may also be more precise with close subjects and it allows the photographer to decide which part of the subject has the maximum sharpness.

It’s important to start with a clear view of the subject. When using a viewfinder, make sure you adjust the optics to your eyesight with the dioptre adjustment.

Manual focusing is straightforward. Set the focus switch on the lens to M or engage manual focusing via the camera’s menu system. Select a focus point and frame the shot so the subject is behind it. Half-press the shutter button to initiate exposure metering then rotate the focusing ring to bring the subject into sharp focus before you press the shutter button all the way down to take the shot.

Many cameras allow you to use manual focusing to fine-tune autofocusing settings. This is handy when shooting close-ups with a hand-held camera and some lenses provide a manual over-ride in the AF mode for just this purpose.

Start by focusing automatically on something that isn’t moving but is at roughly the same distance from the camera as the subject you want to photograph. Then re-frame the shot on the subject and use your left hand to turn the focusing ring on the lens until the image is sharp.

Shooting with manual focusing takes practise – and the more you practise, the easier it will become. It pays to become proficient because you never know when it will be needed.

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**Tips for Minimising Blur**

The best way to prevent blurring caused by camera shake is to mount the camera on a tripod – or set it up on a stationary object like a table or wall. When shooting moving subjects, you’ll need high shutter speeds to freeze action. At least 1/500 second is recommended for shooting sports action or wildlife or recording the actions of small children or pets.

Increasing the shutter speed reduces the amount of time light is allowed to reach the sensor. To compensate, open the lens aperture a stop or two, increase the ISO speed setting or use flash (or two or more of these at a time).

Opening the lens aperture lets in more light but also reduces the range of distances in the scene that appear sharp. Typically at an aperture of f/16, most of the scene will be in focus. At aperture f/4 or wider, only the subject the lens is focused on is sharp; the background and foreground will appear blurred.

Flashes are good for illuminating close subjects but their light is harsh. With an external flashgun you may be able
to bounce the light off a light-coloured reflecting surface (wall or umbrella) instead of pointing the flash straight at the subject. Bounced light is softer and more natural looking but it takes practice to master the technique. Unfortunately, flash isn’t permitted in some places (theatres and sporting venues, for example)

Fast shutter speeds reduce the risk of blurred pictures when shooting subjects that could move erratically. They require you to open the lens aperture, which has the advantage of blurring busy backgrounds.

USEFUL URLs

CHAPTER 8

Shooting in Live View Mode

The live view shooting mode allows you to view and compose photos without looking through the viewfinder. In this mode, the image is displayed on the camera's LCD, using a video stream from the camera's sensor; just as it is with a point-and-shoot digicam.

Most camera settings remain available in live view mode. You can overlay shooting information on the screen by pressing the Info button on the rear or top panel of the camera. Some cameras support histogram overlays to display the brightness range in the scene, while others only display exposure settings.

Many cameras allow users to superimpose grids to assist with shot composition. (These grids aren’t recorded in the captured photo.)

Live view shooting is essential if you want to use a DSLR to record movies. When shooting stills, it’s useful when you want (or need) to hold the camera at an unusual angle or away from your body.

The Quick Control screen from a DSLR camera, with on-screen icons identified. (Source: Canon.)
Detailed shooting information that can be displayed on the live view screen may include a brightness histogram to indicate exposure levels plus exposure compensation adjustments for correcting exposures. Exposure simulation is indicated by the icon in the lower right corner (Source: Canon.)

Many cameras provide a level display to help you keep horizons horizontal.

Live view shooting has some worthwhile advantages. You can see the full scene as the sensor will record it, whereas the viewfinders in entry-level (and many mid-level) DSLRs show roughly 95% of the view. (You may find unwanted items like poles or road signs included at the edges of shots when using a viewfinder for shot composition.)

Cameras with adjustable monitors provide freedom for different shooting angles in live view mode. You can turn the monitor to face down and hold the camera above your head, or face it upwards and shoot with the camera at waist level. You may also like to point the monitor forward to help you compose self-portraits when the camera is on a tripod.

The default live view mode in most cameras is best used when the camera is tripod mounted. Some cameras call this mode ‘Tripod Live View’ as an indicator. In this mode, the image sensor is used to determine focus, based on contrast detection. Consequently, focusing is not only slower than regular AF, but it’s also less accurate.

Tripod Mode is ideal when photographing stationary subjects, such as still life set-ups in a studio or landscapes. Most AF point selection setting are available and when focus is achieved the focus point usually changes colour.
Face Detection technology may be offered with the Tripod Mode. With this setting, the AF system will search for faces in the scene and lock onto the one closest to the camera. Focusing may be slowed by the searching process.

Cameras with a Handheld or Quick mode can support phase-detection AF, where, the mirror flips down momentarily to allow light to pass to the phase-detection sensors. The display blacks out while this happens.

In more advanced DSLRs, the video signal from the camera’s LCD monitor can be fed to an external monitor. This is handy in professional cameras because it allows photographers to work with clients or art directors without having them crowding the shooting area. Some of these cameras also support direct output of uncompressed full HD movie files to an external recorder that has high capacity and allows a much faster film-making workflow.

**Screen Resolution**

The higher the resolution of the camera’s monitor, the better you’ll be able to see detail in the subject. Colours will be more accurately displayed, an important feature when you’re using the screen to assess exposures.

High resolution is also essential for focus checking. Many cameras allow you to magnify the scene for checking focus accuracy or when focusing manually. You

![Shooting with the camera handheld in live view mode usually requires contrast-based autofocusing.](image1)

![The screen above shows the shot composition in live view mode. A simulated magnification for focus checking is shown in the screen below. The grey box in the lower right corner indicates the area in the original scene that has been enlarged.](image2)
can move the magnified area around in the frame with the arrow pad buttons.

Some cameras support as much as 10x magnification, which is handy for macro photography where depth of focus can be very small. In cameras that provide live view depth of field preview, you can select, check and compare different AF points precisely and select the one that delivers the plane of focus you want.

However, even with high-resolution screens, you must match the display’s brightness to ambient lighting. If you don’t, you will probably over-estimate brightness levels if you use the display to gauge exposures.

**Live View Limitations**

If you’ve moved up from a digicam that only offers live view shooting, you may be tempted to use the live view mode on your DSLR all the time and only resort to the viewfinder in very bright outdoor lighting. Although the live view mode has many advantages, it also has some limitations.

The normal phase-detection AF sensors are blocked when the camera’s reflex mirror is raised to expose the imaging sensor. The display on the monitor screen (or EVF in Sony DSLRs), blanks out during this time, coming back when the mirror returns to its normal position. This results in a noticeable focusing lag that can cause you to miss shots, particularly with moving subjects and/or when precise timing is required.

With the viewfinder you can see the focus immediately and take the shot at the right time, with the focus exactly where you want it. The viewfinder’s focusing screen also allows you to check focusing at ALL points in the scene at the same time.

Live view mode also consumes more battery power than shooting with the optical viewfinder. In addition, when using live view for long exposures at night, the mirror doesn’t form a light-tight seal so stray light can enter the camera through the viewfinder and affect the exposure metering. Most cameras provide a switch-in shutter to block the viewfinder – but you must remember to use it.

Photographers usually find it easier to keep the camera steady when the camera is at their eyes and close to the body, rather than held out in front of them. This may not matter much in bright sunlight, but when light levels fall, correct shooting technique really matters.

**Shooting Movies with a DSLR**

You can shoot movies with all modern DSLRs in live view mode. Because they have larger image sensors, they provide an important advantage over camcorders: much greater control over depth of field in recordings. Different lenses can provide different levels
of depth, zoom and focus, allowing photographers to control exactly how scenes are shot.

However, the ergonomics of DSLRs aren’t ideal for recording video. They’re also larger and heavier than consumer camcorders and keeping subjects in focus can be challenging.

Although most cameras provide a choice of AF modes, many cameras lock focus on the first frame in a clip and, while some allow continuous autofocusing – and even tracking AF – it is noticeably slower in movie mode than when shooting stills. Cameras with hybrid AF systems provide faster autofocusing but it’s still not as fast as when shooting stills.

DSLRs usually lack movie functions like zebra pattern overlays for indicating over-exposure. Only professional DSLRs support the codecs (coding/decoding programs) used by professional media so it’s difficult for footage recorded with a consumer DSLR to be used in a professional editing suite.

With many DSLRs soundtracks are recorded by internal microphones, which can also pick up noises made by camera operations, such as focusing and zooming. Audio quality is no better than recording from a smart-phone and well below camcorder standards.

Fortunately more DSLRs are being equipped with 3.5mm jacks for external microphones. But adding a mic. adds extra weight to your kit and extra complexity to the recording process.

Formats, Frame Rates and File Sizes

Most can record at Full HD resolution (1920 x 1080 pixels), which is compatible with high-definition TV sets. HD resolution (1280 x 720 pixels) is also available, along with standard definition VGA (640 x 480 pixels) in most cameras. The aspect ratio of the frame defaults to 16:9 in the Full HD and HD modes and 4:3 with the VGA setting.

The most popular video compression standard is MPEG-4 using the H.264 compression favoured for Blu-ray discs and some broadcast TV formats. AVCHD (Advanced Video Coding High Definition), which was developed by Sony and Panasonic, is used in both manufacturers’ cameras.
AVCHD also uses the MPEG-4 AVC/H.264 compression standard but includes features to improve menu navigation, slide shows and subtitles. While it was developed to support recording to DVDs, discs with AVCHD movies aren’t compatible with all DVD players and dedicated software is required for editing clips.

Different regions of the world have different TV standards, so movies must be recorded in the format that matches the predominant local standard. The PAL (Phase Alternating Line) standard is used in Australia, China, India, much of Europe and parts of Africa and South America. It’s based on a TV display system of 625-lines / 50 fields (25 frames) per second.

The NTSC system is used in Japan, North America, South Korea, the Philippines and parts of South America. It’s based on a TV display system of 525-lines / 60 fields (30 frames) per second.

These differences account for the range of settings found in DSLR video menus. Once you have set your camera to the correct TV standard, only the settings relevant to your area will be displayed. A typical DSLR will offer the following recording modes and capacities:

Most cameras limit clip lengths. Typically, recording will stop automatically if the file size reaches 4GB or after 29 minutes and 59 seconds.
of recording time. A new clip must be created before recording can continue.

Where there’s a choice of frame rates, many cameras offer a slightly slower frame rate of 24 fps, which simulates the frame rate of traditional movie films. However, unless you are transferring to film at this speed or editing movie clips into digitised film footage, it is unlikely you would notice any difference between the 24 fps ‘Cinema’ mode and normal 25 fps recording.

Some cameras provide a 50 fps setting for shooting slow motion scenes. Resolution is usually limited to HD (1280 x 720) in this mode. Although the slow-motion movie can be displayed on the camera’s monitor, post production adjustments may be required to slow it down for TV display.

**Soundtracks**

The built-in microphones in most cameras are indifferent recording devices. Even when there’s a pair of stereo mics, they are too closely spaced to provide the kind of ‘presence’ we’re used to from movie DVDs.

Few cameras allow you to adjust audio levels and of these, many lack the facilities for connecting an external microphone, which separates the pick-up device from the camera and reduces the chance of recording operating sounds. If you’re interested in producing high-quality movies with a DSLR, it’s best to record the soundtracks separately with a dedicated recorder. Note: this doesn’t mean you should mute the in-camera recording because it can be helpful for synchronising the soundtrack with the visuals.

**Movie Shooting Tips**

The following tips will help you to make your movies as professional-looking as possible with your equipment.

1. Take advantage of stabilisation.

   Lens-based image stabilisation, in particular, copes very well with hand held jitters but can’t handle large, fast movements. Try to move slowly and steadily if you must move while shooting and turn the camera slowly during panning shots.

<table>
<thead>
<tr>
<th>Movie mode</th>
<th>Movie resolution</th>
<th>Frame rates</th>
<th>File size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full HD</td>
<td>1920 x 1080</td>
<td>30/25/24 fps</td>
<td>330MB/minute</td>
</tr>
<tr>
<td>HD</td>
<td>1280 x 720</td>
<td>60/50 fps</td>
<td>330MB/minute</td>
</tr>
<tr>
<td>VGA</td>
<td>640 x 480</td>
<td>30/250 fps</td>
<td>82.5MB/minute</td>
</tr>
</tbody>
</table>
2. The ideal shutter speed should be exactly twice the frame rate (i.e. 1/50 second if shooting at 25 fps). Increasing the shutter speed may give you a sharper image, but it will also increase the gaps between the movement captured in each frame. Beyond a certain point, the movie will appear clipped and stroboscopic – and uncomfortable to watch. Tracking and panning at high shutter speeds will be very jumpy, and probably unwatchable.

3. Learn the limitations of the camera’s AF system in movie mode. If your camera offers zoom focus, use it to check the focus is spot on before starting to record. Practice pulling focus (shifting focus from area in the frame to another) before shooting to ensure the recording is as smooth as you can make it.

4. Although DSLR cameras can outstrip camcorders in low light levels, having enough light and the right amount of light can make a noticeable difference to the end result. Video lights are available to illuminate deep shadows and some are small enough to fit on the camera’s hot-shoe.

5. Keep clips short – unless you are trying for a specific effect or waiting for an action to unroll. Professional shooters follow this rule, as you can see at the movies.

USEFUL URLs

CHAPTER 9
Why Shoot Raw?

Professional photographers and serious enthusiasts capture still images as raw files whenever possible. The reason is simple: raw files provide more image data and give photographers much greater control over white balance, saturation, sharpening and contrast in their images.

While all digital cameras record images in JPEG format, only more sophisticated cameras provide the option of recording raw files. All DSLRs support raw file capture so you might as well learn how to take advantage of it.

Raw vs JPEG
When an image is captured in JPEG format, the image processor in the camera converts the raw image data into Red, Green and Blue (RGB) pixel values (a process known as demosaicing). It then applies white balance, saturation, sharpening and other adjustments according to pre-determined formulae.

![The above image was recorded in JPEG and raw file formats.](image-url)
These settings are effectively locked into the image file.

At the same time, the image is compressed to reduce the amount of storage space it occupies. And this is the main downside of the JPEG format: image data is lost during this process. The more the image is compressed (by adjusting the Quality setting), the more information is discarded.

Each time an image is saved in JPEG format, the compression process is repeated and more data is discarded. This ‘lost’ data can never be recovered. After several cycles of compression, your image may become unusable.

The actual size of a JPEG file depends on the complexity of the subject in the photograph. Shots containing large areas of blue sky can tolerate more compression so they can be two to three times smaller than pictures of detailed subjects - even though they might have originally been the same size as uncompressed files.

When you shoot raw files, all of the information recorded by the sensor is available to create the digital image. Nothing is discarded, even when the image processor compresses the raw file to make it smaller. (The compression is ‘lossless’ which means all of the image data is usable by the photographer for subsequent editing.) Raw files don’t store colour, which means you can re-set colour values – including the colour

![These crops from the centre of the image show the quality differences between raw (top) and JPEG (below) files resulting from the different amounts of image data each file contains.](image)

![Image recording quality options in an entry-level DSLR. The raw file settings are circled in red. (Source: Canon.)](image)
space – when files are converted into editable formats.

Raw files make a huge amount of data available for photographers to adjust. Whereas JPEGs are only 8-bit in size and can record a maximum of 256 tonal levels for each pixel, with raw files you end up with 12- or 14-bit files. A 14-bit raw file would give you 16,384 possible tonal values per pixel, which gives you much more data to work with.

All raw files contain embedded JPEG images, which are used for the preview image on the camera’s LCD and for histogram calculation. But, because these JPEGs have been processed by the camera, if you use these histograms to evaluate exposures, make sure the camera’s exposure and white balance settings are appropriate for the subject. Mismatched settings will result in incorrect exposures.

The worst aspect of raw files used to be their size. However, nowadays storage is cheap and high-capacity memory cards widely available so this is no longer an issue.

The remaining disadvantage is that raw files are usually proprietary. Not only is Canon’s format different from Nikon’s, Olympus’s and Sony’s and everyone else’s, but raw formats may also vary from model to model within a manufacturer’s range.

Before you can edit raw files they must be converted into an editable format - normally JPEG or TIFF (Tagged Image File Format). This requires special conversion software, which is normally supplied with the camera.

**Raw File Converters**

Unfortunately for photographers, the capabilities of conversion software vary widely between different manufacturers. Some have intuitive user interfaces; others are clunky. Different manufacturers provide different adjustments and different levels of adjustment. Nikon, for example, bundles a very basic converter (ViewNX2) with new cameras but charges more than $200 extra for its more powerful and capable converter: Capture NX 2.

A good raw file converter will allow you to correct errors in exposure, adjust brightness levels to ensure both highlights and shadows contain detail, remove colour casts and, generally, make your digital photograph look as much like the original scene you photographed without losing any of the fine tonal nuances that make the difference between an excellent digital picture and a poor one. And, because all adjustments are done on your own computer, you have much more processing power at your fingertips than the camera can possibly provide.

Raw converters are constantly changing, usually for the better. Many recent converters include noise...
RAW FILES

DNG

Pentax and Leica are the only camera manufacturers to offer the ‘universal’ DNG (Digital Negative) raw format in their latest cameras. This file format was developed by Adobe and launched in September 2004. All Adobe software released since that time can open and convert DNG.RAW files.

A DNG file always contains the data for rendering an image without needing additional knowledge of the characteristics of the camera. There’s an option to include at least one JPEG preview to DNG files. These features ensure it is as ‘good’ as a proprietary raw format – but much cheaper and easier to use.

Although new versions of DNG are released periodically, full compatibility with older versions is maintained, enabling older versions of, say, Adobe Photoshop and Photoshop Elements to open DNG files from the latest digital cameras.

reduction algorithms and corrections for chromatic aberration, rectilinear distortion and vignetting.

Unfortunately, to take advantage of these features you have to keep pace with developments. You’ll probably need to update converters each time you buy a new camera body – and this can prove costly.

Third-party converters are popular with both professional photographers and serious enthusiasts, with Adobe Camera Raw (ACR) and Phase One’s Capture One being the leading products. ACR is a free download for users of Photoshop and Photoshop Elements but you must have the latest version of each application installed.

This requires regular updating of your software, something you may be reluctant to do if the existing application does everything you need.

Converting Raw Files

In this section we will use Photoshop’s Adobe Camera Raw (ACR) because it’s our preferred raw file converter. ACR provides a wealth of adjustments; more in Photoshop than in Photoshop Elements, but even the adjustments available in Photoshop Elements exceed those provided by many proprietary converters.

We don’t have space for step-by-step instructions for using ACR. Instead, we’ll explain the key features provided
in its workspace and how to use them when adjusting raw files. When you open a raw file, you’ll see a large preview window in the left side of the workspace, showing the entire image.

You can adjust the magnification of the preview by clicking on the + and - buttons in the lower left corner or with the Zoom tool at the left hand end of the top toolbar. This toolbar also contains tools for moving the image around in the preview window when zoomed in, sampling image colours to check white balance, cropping and straightening images, removing small blemishes, correcting red eyes in flash shots, masking out part of the image, applying a graduated filter and rotating the image in either direction. (Mouse over each icon to see what the tool does.)

Different photographers will use different tools from this collection. We’ve found the most useful tool to be the straightening tool as other adjustments are easier to carry out once the image is opened in Photoshop.

Most adjustments are carried out within the Basic Panel on the right side of the preview window. We’ll work our way down the list of sliders.
Temperature shows the color temperature of the White Balance setting used for the photograph. If the image colour isn’t correct, you can adjust the White Balance in one of four ways:

- by moving the slider to make the image appear as you’d like it to;
- by setting the numeric value to a specific value;
- by clicking on a neutral toned area within the preview image using the eye dropper;
- by choosing a standard value from the White Balance selector at the bottom left of the window.

Tint allows you to fine tune the colour balance.

Below the Tint slider are two ‘hot’ buttons: Auto and Default. Clicking on the Auto button adjusts the image to what the software ‘thinks’ is should look like. The values in the sliders below change to reflect these adjustments. The Default button sets the values to zero, reflecting the values recorded by the camera.

In Photoshop there are nine parameters you can adjust with sliders.

Exposure sets the overall brightness of the image. Adjustments you make are reflected in the preview image and also in the histogram above the Basic Panel. If there’s a lot of black in the image, the histogram will have a large spike on the left side. Over-exposed images will show the histogram biased towards the right.

Use the Exposure slider to make sure that you have good tones throughout the image and that the blacks and whites are as accurate as possible. Triangles in the upper-left and upper-right corners of the histogram warn you when tones are ‘clipped’, which means details can no longer be recorded. Try to keep the graph between these indicators – but remember that if you’ve included a very bright area (like the sun) in the shot, no amount of image adjustment will get rid of the clipping warning.

The Contrast slider is centred by default. Moving it to the right will increase contrast in the middle tones of the image.
Moving it to the left can reduce tonal differences in the middle tones by making dark areas lighter and light areas darker.

The **Highlights** slider lets you darken very light areas and can help you to pull some colour back into bright skies.

The **Shadows** slider adjusts dark image areas. Drag to the left to darken shadows or to the right to brighten shadows and recover shadow details.

The **Whites** slider adjusts white clipping but only works when whites are only slightly clipped. To reduce clipping in highlights, drag the slider to the left, while to increase clipping specular highlights, such as metallic surfaces, drag the slider to the right.

The **Blacks** slider adjusts black clipping in a similar fashion.

Below these sliders are three additional sliders for Clarity, Vibrance, and Saturation.

**Clarity** adds depth to an image by increasing local contrast. It has the greatest effect on the midtones.

**Vibrance** adjusts colour saturation (the intensity of colours) without going overboard and causing colours to be clipped. Colours with lower saturation are boosted more than highly-saturated colours, allowing skin tones to be enhanced without becoming unnaturally looking.

**Saturation** adjusts the saturation of all image colours equally from -100 (monochrome) to +100 (double the saturation). This slider must be used very cautiously as excessive saturation produces lurid colours.

The link below the preview window allows you to set the output file format and bit depth for the processed image when it is opened in Photoshop. ACR lets you choose between JPEG and TIFF (Tagged Image File Format) and you can choose 8-bit or 16-bit for TIFF files.

Selecting 16-bit TIFF gives you the maximum amount of data to work with. This is the best option when you plan to make additional adjustments in Photoshop and it’s easy to reduce images to 8-bit after all processing is done if you want to save them as JPEGs for sending in emails or displaying on screens. Stick with 16-bit TIFF files for images that will be printed or archived.

**USEFUL URLs**

- [http://www.bythom.com/qadraw.htm](http://www.bythom.com/qadraw.htm) for a summary of what you need to know about raw files.
- [http://www.bythom.com/dng.htm](http://www.bythom.com/dng.htm) for a professional photographer’s commentary on the DNG raw file format.
CHAPTER 10
Editing and Sharing Photos

Most DSLRs provide at least some post-capture editing controls, with functions like cropping and resizing, brightness and contrast adjustments and basic colour adjustments being almost universal. In-camera raw file conversion is also common, although it’s limited to converting raw files into JPEG format in most cameras.

The main problem with in-camera editing is it usually applies the same processing as the camera uses to create JPEGs at point of capture. This makes it more useful for correcting minor faults after images are recorded than as a genuine editing tool. Even special effects filters are based on pre-sets developed by the camera manufacturer and usually include limited adjustments.

Most in-camera editing controls allow you to save edited images as separate copies of the file. This is highly desirable because it leaves you with an original image to archive for the future plus the adjusted JPEG file for immediate use. (Originals are easily copied for further editing whenever you want to work on them.)

In general, we see little point in converting raw files into JPEGs in the camera when you gain far greater control over the quality and appearance of the end result by processing them with proper conversion software on your computer. Computer-based conversion also enables you to save raw files as 16-bit TIFFs, which contain the maximum amount of data to work with.

The most valid reason for using in-camera raw file conversion is when you want to send images directly from your camera, using Wi-Fi (see page 98). With the rising popularity of social networking, an increasing number of photographers want this capability – and camera manufacturers have started to take notice.

Image Editing

Most digital images will benefit from a little tweaking in an image editor and some actually require editing to bring out their best characteristics. Since editing can be a lot of fun and reward you with images you’ll be proud to display and share, it’s worthwhile learning some basic improvements that be achieved with editing software.

We don’t have space to cover all aspects of image editing so we’ve decided to concentrate on simple adjustments that are virtually guaranteed to make your images look better: levels
adjustment and unsharp masking. Both are provided in all popular image editors, although the actual tools may be in different dropdown sub-menus.

**Levels** adjustment is normally the first step in an editing workflow because it lets you distribute the tones in the image correctly. At the same time, it allows you to adjust the brightness, contrast and tonal distribution in an image via a histogram.

In Photoshop, the Levels tool is accessed by opening the image and selecting Image > Adjustments > Levels, as shown in the illustration on this page.

Clicking on the Levels tool opens the histogram that graphs the tonal distribution in the image. The graph for each image will be different which means there’s no universal way to obtain optimal settings for applying to all images; you must work on each shot individually.

The levels histogram specifies the location of complete black, complete white and the midtones in the image. In the screen grab shown here, the image tones are contained within the 256-step scale delineated by the horizontal axis of the graph, which defines the ‘Input Levels’.

Three sliders are located on this axis. By default the black (left end) slider is set at 0, the white slider is at 255 and the middle slider is at middle grey (128).

The initial adjustment for this image involves dragging the black and white sliders in until they reach the end points.
EDITING & SHARING

Dragging the black and white sliders in to the points indicated by the red arrows spreads the tones in the image to cover the full tonal gamut that can be displayed and printed.

The top image shows the original JPEG before adjustment. The image below shows it after the basic levels adjustment shown in the second histogram.

in the histogram (indicated by the red arrows), which extends the tonal range in the image to cover the full 256-step tonal gamut. Most images look best when they contain the full range of tones from dark (0) to light (255) as it’s the tonal range that can be displayed on a screen or in a print.

The end result can be quite dramatic, as shown in the illustrations on this page.

While dragging the black and white sliders in to the end points works for most images, there are some where it isn’t successful so it’s important to pay attention to the content of the photograph as you make adjustments. (Note: all adjustments to the histogram will be reflected in the image as they are made so you can see their effect in real time.)

Photographs taken in fog, haze or very soft light may never contain the full tonal gamut so stretching the black and white points to the ends of the horizontal axis can destroy their tonal balance. Images where whites or black are clipped will open with histograms that are skewed to the right or left ends of the axis. In each case, there is no way to recover clipped tones. All adjustments will need to be made with the grey slider and whichever of the other sliders has room for adjustment.

The grey slider can be used for subtle tonal adjustments. Moving it to the left brightens mid tones and shadows by stretching out the shadows and
compressing the highlights. Moving it to the right darkens mid tones and shadows by stretching the highlights and compressing the shadows.

Having adjusted the image levels to your satisfaction, you can move on to make any other necessary adjustments to brightness, contrast and colour using the normal editing tools. The final step in the editing workflow is sharpening and for it we use the Unsharp Mask tool.

All digital images are slightly soft directly from the camera because of the process that is used to create the colour images. Consequently, they will benefit from some degree of sharpening.

Unsharp masking works by creating a slightly blurred version of the image, which is mathematically subtracted from the original image to detect any edges in the scene. The contrast differences at the edges are selectively increased to produce a sharper-looking image.

The Unsharp Mask dialogue box contains three sliders: Amount, Radius and Threshold.

The Amount is usually listed as a percentage. It controls how much contrast is increased at the edges. Because over-sharpening can introduce artefacts, the position of this slider should be at least partly dictated by the output size for the sharpened images. The percentage should be kept low (40-60%) for small prints but can go above 100% for A3 and larger prints.
The Radius slider controls the amount of blur used to create the mask. Keep it small when you need to enhance fine detail.

The Threshold slider controls the minimum brightness change that will be sharpened. It can be used to sharpen well-defined edges, while leaving subtle edges untouched, for example when sharpening eyelashes without affecting skin texture.

The general rule for unsharp masking is to be guided by the enlarged preview in the dialogue box. It’s easy to see when you go too far because bright lines will appear along contrasty edges in the preview and the image starts to appear fragmented.

While sharpening with an unsharp mask is quick and easy, like all editing tools it needs practice to become truly competent with its usage. Images containing very subtle textures and tones must be handled with great care as this method of sharpening may introduce slight colour shifts. Fortunately, it’s easy to undo changes with most image editors and keeping the Radius setting low minimises the chance of artefacts.

The first step in the sharpening process is to adjust the Amount slider.

The top image shows the original JPEG before adjustment. The image below shows it after unsharp mask adjustment.
Editing Software

Although there’s a wide range of image editors available, most photographers limit their choices according to their needs and their budgets. If your budget is tight, freeware applications range from very simple programs like Google’s Picasa to sophisticated editors like GIMP, which is an open-source program that is continuously evolving.

Both these programs can be run on Windows, Macintosh and Linux operating systems and both are reasonably easy to use, given their different levels of complexity. If you only need an application that will ‘manage’ your photos when you upload them to your computer and provide basic tools for adjusting brightness, contrast and colour as well as cropping and resizing, we’d recommend trying Picasa.

But if you’re looking for cloning and healing tools, want Levels and Curves adjustment and greater control over tonal rendition in shadows and highlights, GIMP is the best freeware program we’ve found. Available at http://www.gimp.org/downloads/, it doesn’t include raw file processing, although it can handle many different file types (including TIFFs).

While freeware applications are often very capable, the level of support is negligible, whereas purchased products tend to provide at least some online support and often include help screens.

This makes them better for photographers with minimal computer experience.

Adobe products are the choice of most professional photographers, with the very expensive but powerful Photoshop being the leader in the pack. Photoshop Elements, which is considerably cheaper, contains enough features to satisfy the needs of most photo enthusiasts.

Like Photoshop, it supports Adobe Camera Raw and allows you to edit 16-bit TIFF files. Other applications that support 16-bit TIFF editing include ACDSee Pro, Corel Paint Shop Pro and Serif Photo Plus.

Most applications are available as trial downloads from the developers’ websites. Try-out times range from 15 to 30 days, during which time you can use the software for free. When the trial period expires, you will be offered the opportunity to purchase the application.
**Wi-Fi**

Cameras with built-in Wi-Fi became popular during 2012, although the technology has been around for more than half a decade. However, the infrastructure for transmitting image files wirelessly has taken time to develop, and so has the motivation for camera users to adopt Wi-Fi for uploading images and movies to the internet.

So far, very few DSLRs have Wi-Fi support built-in but almost all of them can use Wi-Fi cards, which provide an alternative way to access the internet. And while the rush to join Facebook and Twitter is slowing, there are still plenty of people who would like to be able to send files directly from their cameras to the Net.

Unfortunately, using Wi-Fi is not quite as straightforward as its promoters claim. Different manufacturers have implemented it in different ways and there’s no standardisation of interfaces.

Cameras with built-in Wi-Fi have interfaces that can take you through the

Canon’s EOS 6D is one of the few DSLRs on sale with integrated Wi-Fi, circled in red in this illustration. (Source: Canon.)
set-up process step-by-step using on-screen commands. The same is true with Wi-Fi cards, although different cards are configured in different ways.

Eye-Fi cards must be configured through a computer and come with a card reader to simplify the process. The ezShare cards must be configured in the camera and are marginally simpler to set up, although not quite as easy to use.

To make any system work you must be within range of a registered Internet network and the camera must be turned on. You must also set up security protocols.

**Why Use Wi-Fi?**

Theoretically, if you have Wi-Fi, either in the camera or memory card, you should be able to:

- Upload images and video clips to sharing websites;
- Email photos while you’re travelling;
- Back-up image and movie files to cloud storage (such as Picasa Web Albums or Dropbox);
- Send images and movies to smartphones and tablet PCs.

The first three functions require an access point to be available. Transmitting images to smart-phones and tablet PCs requires you to set up connections between the camera and the relevant device and be within transmission/reception range.

If you’re an active social networker and enjoy sharing images and movie clips through Facebook, Flickr, Twitter, eMail or other social networks, Wi-Fi could make uploading your photos quicker and easier than using a computer. The Endless Memory function in Eye-Fi cards (which automatically transfers files to online storage as the card fills) could be convenient for family shooters and business users as it will ensure there’s always space on the memory card for images and movies.

Provided an access point is available, Wi-Fi can also provide a way to back-up files as you shoot and upload shots to the server at a lab for outputting (as prints or on DVD) while you’re travelling. However, until the reliability of the global internet infrastructure is assured, there will always be some risk involved in choosing this way to back up files.

Wi-Fi is also comparatively slow. Moving a high-resolution JPEG from a 16-megapixel camera can take roughly 20 seconds. Raw files can take a minute or more – if the Wi-Fi device can transfer them.

As a general observation, Wi-Fi in its current implementations is no better than cables for a typical photographer’s workflow. In practice, it’s often a lot slower and more cumbersome than slipping a card into a reader connected to the computer.
If you’re not into online image sharing and/or don’t store files ‘in the cloud’ we can see few advantages in using Wi-Fi. When you can buy a 16GB Class 10 SDHC UHS-1 card for less than $30, paying more than three times that price for a slower 8GB card doesn’t make a lot of sense.

If you don’t include the time taken to power-up your computer, you can usually upload files to social networks and ‘cloud’ storage via card reader quite a bit faster than sending them via Wi-Fi. And you’re not restricted to using expensive SD cards.

USEFUL URLs

- http://www.cambridgeincolour.com/tutorials/levels.htm for more information on levels adjustment.
The third edition of Photo Review Australia’s popular Digital SLR Pocket Guide has been completely updated to include recent technological advances, while retaining the easy-to-read style and straightforward presentation of its predecessor.

Whether you’re a newcomer to DSLR photography or upgrading an existing DSLR, this handy guide will provide the resources you need to take better pictures.

Starting with an overview of the features that characterise a DSLR, we provide a range of shooting tips and we show you step by step how to use the most important controls effectively.

You will also find guidance on basic image editing and sharing your best pictures via social networks and Wi-Fi.

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